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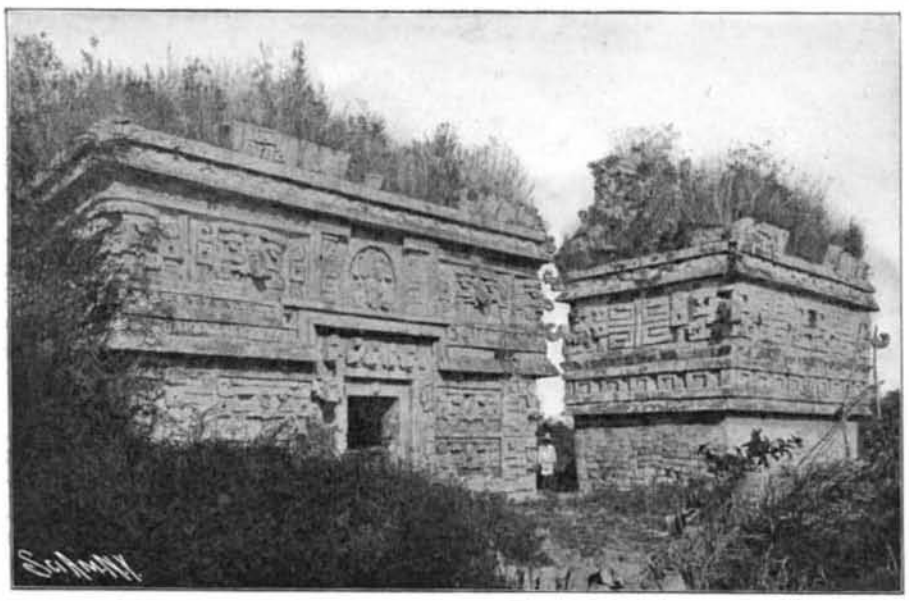
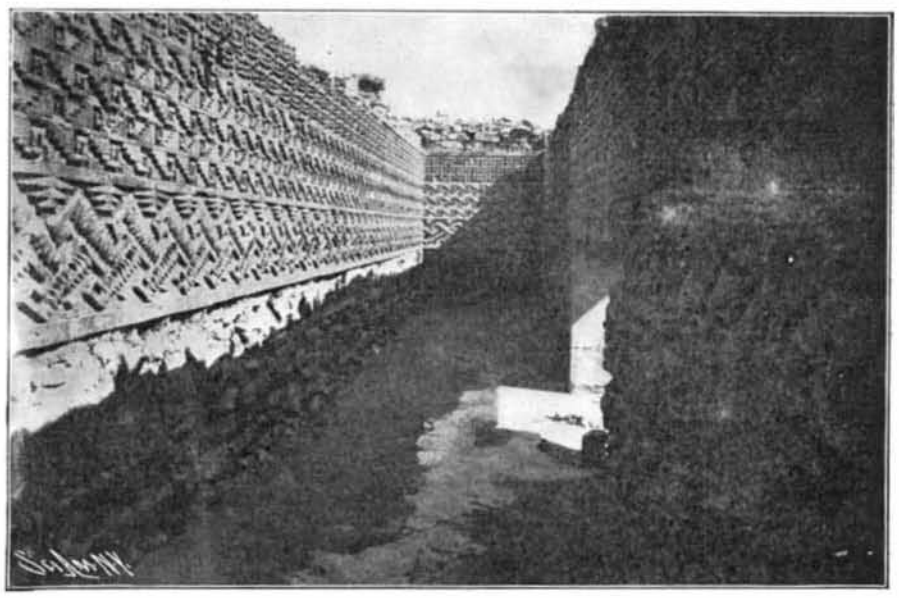


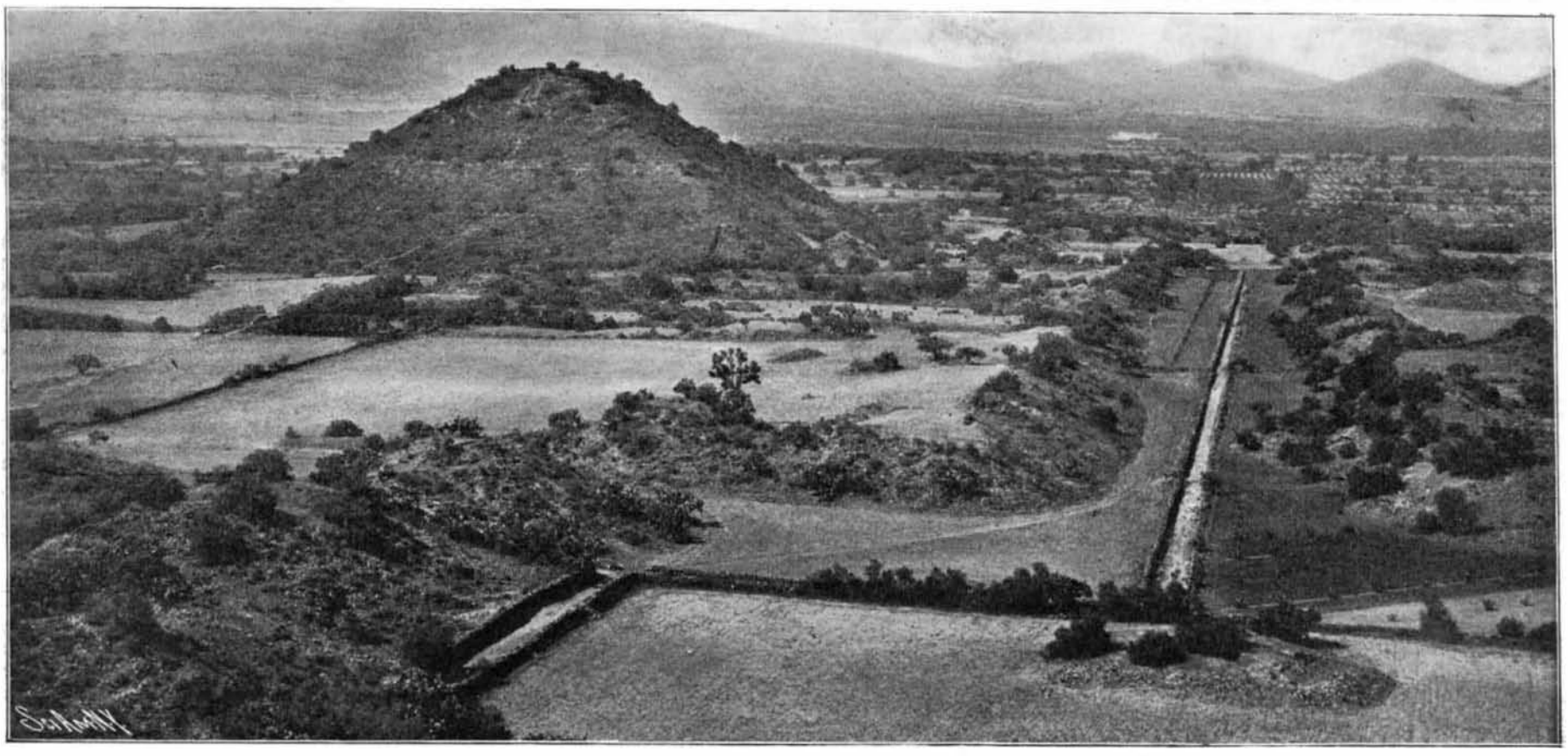
Eastern Facade of the Great Building Called "The Nunnery."



Interior of a Chamber of the Temple of Columns, Mitla, Oaxaca, Mexico.

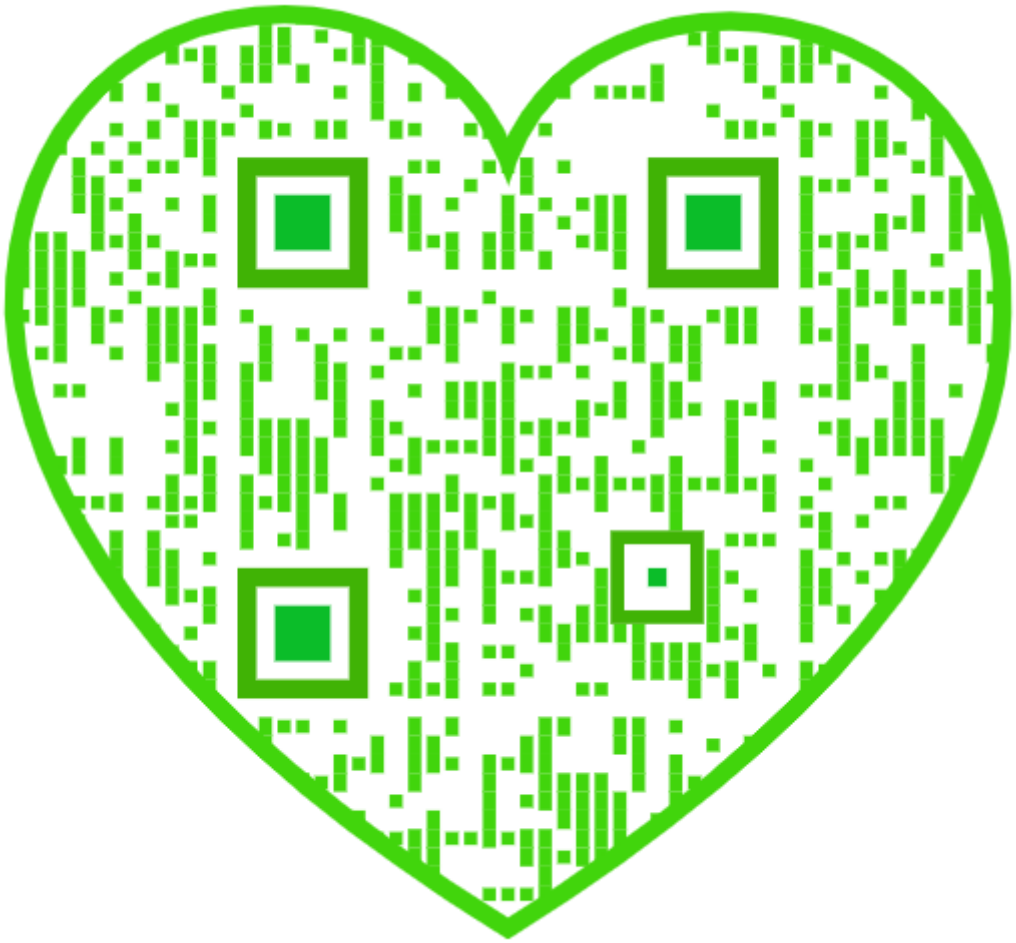
Interior of Temple of the Columns at Mitla, Oaxaca, Mexico.

Pyramid Facing the Roadway of the Dead, San Juan.



General View of the Ruins of San Juan, Teotihuacan, Valley of Mexico, Looking Down the Roadway of the Dead at the Right. To the Left is the Pyramid of the Sun.

THE ANCIENT RACES OF YUCATAN AND MEXICO.—[See page 375.]



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NEW YORK, SATURDAY, NOVEMBER 26, 1904.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

PORT ARTHUR.

The center around which revolves the whole complicated naval and military situation in the Far East is located at Port Arthur. The key to the situation is held by that heroic commander, Stoessel, and in a sense it may be said that by his stubborn defense he has locked up three of the most important elements in the war, namely, the Russian fleet within Port Arthur, the Japanese blockading fleet without the harbor, and the Japanese army of investment of 60,000 men. Incidentally, it may be said (still keeping to our metaphor) that Stoessel also holds the key to the deadlock into which the opposing armies of Kuropatkin and Oyama have fallen before the walls of Mukden.

There is, therefore, much more of method than of madness in the heroic stand taken by Stoessel and his gallant troops. At the present juncture there is no doubt that the Russian forces, and indeed the whole Russian plan of campaign, are in an exceedingly critical condition. It is also certain that if they can maintain the *status quo* for two or three months longer, the position may be entirely reversed, and the opportunity for a successful prosecution of the war by Japan be let slip forever.

As matters now stand, the last two great battles of the Manchurian armies seem to prove that they are so nearly matched that, in spite of her successes, it is impossible for Japan with her present forces to win an absolutely decisive engagement. It needs no intimate knowledge of strategy to understand that a decisive battle can be won by the Japanese only if they succeed in outflanking the Russian army and securing a strong position across the railroad, cutting off the Russians from their base of supplies. In the two great battles that have occurred at Liao-Yang and the Sha-Ho, flanking movements were made by Kuroki and by Kuropatkin, and in each case they failed for the reason that the flanking army was not powerful enough to cut loose from the main body with any hope of successfully effecting its object. There is no doubt that in planning the campaign, the Japanese strategists expected that by the time their Manchurian armies effected a junction before Liao-Yang, Port Arthur would have fallen, and the army of investment would have been available to give Japan the numerical superiority necessary for a great turning movement. It is the unexpectedly-stubborn resistance of Stoessel and his troops that has saved the situation for Kuropatkin. Every day that Port Arthur can hold out means the addition of so many thousand men and so many scores of guns to the Russian forces, and the more complete development of a successive system of entrenchments to which the Russians can retire, should it become necessary to fight a series of rear-guard actions.

Furthermore, judging from the slow work that has been made in reducing the outer line of forts at Port Arthur, it begins to seem fairly possible that the Baltic fleet, on its arrival in Chinese waters, may find the remnant of the Port Arthur garrison still holding the line of forts to the southwest of the city, on what is known as the Tiger's Tail and the Liau-Tie-Shan Peninsula; and although such possession would not enable the Baltic fleet to use Port Arthur for refitting, it would involve the retention of a large portion of General Nogi's troops that are badly wanted elsewhere. Moreover, it cannot be doubted that a certain amount of repair work is being done on the five battleships that were driven back into Port Arthur after the sortie of August 10. When the fall of the fortress itself is imminent, and these battleships are in danger of being sunk by Japanese high-angle fire, it is safe to say that they will make another desperate effort to break through Admiral Togo's fleet, and reach the sheltering port of Vladivostock. Every day that Stoessel can hold out is another day gained for putting these ships in condition for a running fight; and it is scarcely possible, even if the Russian fleet should be scattered or sunk, that Togo's battleships will come through the fight without more or less serious injury. If the dash for Vladivostock can be delayed for a few weeks longer, it will take place when the Baltic fleet is within a month's or even less than a month's steaming of Port Arthur—all too short a time for the Japanese navy, worn as it is with the stress of a long blockade, and just emerging from a fight against a superior number of battleships, to enter the drydocks in Japan and get in shape to meet a fleet of seven battleships, most of which are fresh from the builders' hands in the Baltic yards.

It has lately transpired that in June last the "Yashima," one of the Japanese battleships, was sunk by a mine off Port Dalny. This leaves the Japanese with but four available battleships to oppose the five battleships in Port Arthur and the seven that are included in the Baltic fleet; and the longer that Stoessel can hold out at Port Arthur, the more will these four ships (all too few for their work) stand in need of refit and repair. If, on the other hand, Port Arthur should fall to-morrow, Nogi's troops would be rushed to Mukden, and the Russian Manchurian army would in all probability, be driven back beyond Mukden, if not into Harbin itself, in a succession of flanking movements. Port Arthur would be closed to the Baltic fleet, and the ships that it shelters scattered or sunk, while the Baltic reinforcements, should they determine to continue on their mission, would find Admiral Togo's and Admiral Kamimura's combined fleets, fresh from a thorough overhauling at the Japanese dockyards, settled down to the blockade of Vladivostock—the only port in which the newly-arrived relieving fleet could hope to find harborage. One would have to search far into the history of naval and military wars of the past to find a situation where the fate of a whole campaign on land and sea depended so immediately and utterly upon a beleaguered fortress, as does the issue of the present war upon the brave troops and indomitable commander at Port Arthur.

HYDRAULIC JET PROPULSION.

It sometimes happens in the world of engineering, that a system is condemned in the earlier stages of its exploitation on the ground that it is wrong in theory when, as a matter of fact, it is the mechanical appliances through which it is endeavored to render the system practicable that are at fault. It would seem as though a case in point were that of the jet propulsion of vessels, which was so uniformly unsuccessful in its earlier attempted applications as to lead to the general belief that it was inherently wrong in theory. Vessels were propelled by the hydraulic jet; but under such low efficiency as to render the system useless for commercial purposes. The improvements which have been made of late years in hydraulic apparatus, and the better understanding of hydraulic principles, have led an English firm to make an extensive series of tests, which have enabled them to install a system of jet propulsion, whose efficiency, according to figures given by our esteemed contemporary the Yachtsman, rival the performance of the screw propeller. The firm in question, in designing the motive power of a small auxiliary yacht, directed their attention expressly to the question of suitable propellers; and among other methods that seemed to offer a satisfactory solution for the vessel in hand, the hydraulic jet propeller received careful attention. The British naval authorities, it was found, had twice already made practical tests of the jet. The first was made half a century ago in a small gunboat, and the second in 1883, in a second-class Thornycroft torpedo boat. In both cases the results were discouraging because of the low efficiency secured, which, in the latter case, amounted to only 0.32, as compared with a similar screw-propelled boat which gave an efficiency of 0.50.

Apparently these results settled the fate of jet propulsion forever; but in examining the experiments more carefully, it was found that the inefficiency was not in the type of propeller, but in the faulty machinery employed. To explain more fully, it should be understood that hydraulic jet propulsion involves the use of a water pump (generally of the centrifugal type) which draws in water through an inlet in the bottom of the vessel and expels it astern as a jet, the reaction of the water driving the vessel ahead. In the jet propellers tried in the British navy there was a loss of efficiency, first, at the inlet of the water, second, in the pump, and thirdly, in the jet. In the Thornycroft experiments the pump losses amounted to 54 per cent, and the loss in the jet to 30 per cent. In view of the great improvement that has taken place in pumping machinery, the low efficiency did not seem so very discouraging, as the latest types of centrifugal pumps were known to show a much higher efficiency than 0.46, while it seemed certain that the loss of 30 per cent in such a simple matter as a jet could be considerably reduced. Inquiry among the leading makers of the world showed that several firms were prepared to supply pumps of 10 horse-power and upward of a guaranteed efficiency of not less than 80 per cent.

The study of jet efficiency was carried on by utilizing different forms of jets, connected by flexible rubber tubing to the supply pipe, and held in the direction of the flow of water by a spring balance, which recorded the jet reaction. In this way efficiencies ranging from 0.65 to 0.90 were obtained. The latter striking result was given by a jet which has turbine guide blades inserted in the discharge orifice, whereby the issuing water is accelerated in velocity and deviated in direction, and discharged in a number of thin, broad jets, each equal in propelling power. In this form of propeller an efficiency of 85 was easily obtained, and over 90 per cent was actually recorded. Comparing these results with those obtained in the Thornycroft torpedo boat of 1883, in the latter case the efficiency of the pump of 0.46 and of the jet of 0.7 gave a total efficiency of 0.32, whereas the results of the 1904 experiments gave a pump efficiency of 0.80 and a jet efficiency of 0.85, making a total efficiency for the jet propulsion of 0.68. This seems to bring hydraulic propulsion, in the sizes thus experimented with, well up to the level of the efficiency of screw propulsion. It is claimed by Mr. Rankin Kennedy, the engineer by whom the experiments were carried through, that the data given above is borne out by experiments with water jets made at the Massachusetts Institute of Technology, in which, by improving the forms of the jets, an efficiency of 99 per cent has been observed. If such jets could be applied as propellers, with pumps of 80 per cent efficiency, it is argued that taking, say, 95 per cent as a practical jet efficiency, a total efficiency of 0.76 would be secured, as against an efficiency of 0.71, which, according to this authority, is the highest efficiency observed in tests on the best screw propellers under most favorable conditions. The results obtained by the jet in these experiments are certainly very remarkable, and show a great advance on previous performances; but we think it is doubtful if the same efficiency will be obtained under conditions of actual service.

THE VAST RAILROAD SYSTEM OF THE UNITED STATES.

Although the total mileage of the railroads of the United States exceeds 200,000 miles, the building of new roads shows no signs of abatement. The total length, on December 31, 1903, according to Poor's Manual for 1904, was 206,886 miles. This represented a net increase on all railroads, during the year, of 4,774.61 miles. The liabilities were made up of capital stock, amounting to over $6,000,000,000, a funded debt of $6,000,000,000, and other smaller items that served to bring up the total liabilities to about $15,000,000,000. The principal assets consisted of $11,000,000,000, representing the cost of the railroads and equipment, and over $2,500,000,000 representing investments. On this huge system there were carried over 696,000,000 passengers, and about 1,300,000,000 tons of freight. The earnings derived from passenger traffic amounted to $429,000,000, while the earnings on freight reached a total of $1,338,000,000, other items bringing up the total traffic revenue to $1,908,857,826. The net earnings reached a total of $592,000,000, and other receipts brought up the total available revenue to $682,000,000.

The operation of the system requires the services of 44,529 locomotives, 28,648 passenger cars, over 10,000 baggage and mail cars, and no less than 1,524,150 freight cars. The growth of this stupendous system, with the exception of two or three periods of stagnation, has been remarkably even. In the year 1830 there were 23 miles of railroad in operation, in 1850 there were 9,121 miles, in 1860 the total had risen to over 30,000 miles, and in 1880 to over 93,000 miles. Fifteen years later, or in 1895, the trackage had doubled to 181,065 miles. The largest annual increase of mileage was in 1887, when 12,876 miles of new track were built. The next largest increase was in 1882, when 11,569 miles were added. The increase in the twentieth century seems to have settled down to a steady rate of between 4,000 and 5,000 miles each year. The growth of the equipment presents some interesting figures. In 1880 there were 17,949 locomotives, 12,789 passenger cars, and 539,255 freight cars. Fifteen years later these figures had more than doubled, the total number of locomotives in 1895 being 36,610, of passenger cars 26,419, and of freight cars 1,230,798. The full significance of the above statistics can only be realized, when it is borne in mind that with the increase of mileage and equipment, there has been a steady improvement in the quality of roadbed, structures, cars, and engines. The best of the railroads of the United States are fully the equal in most respects of the best European roads. In some respects they are superior, and in others not so good. In comfort of travel our cars are acknowledged to be unsurpassed; but there is still room for improvement in respect to the number and speed of our scheduled express train service. It is not, however, improbable that this country will be the most active in the extensive practical application of

electric traction on trunk roads, just as it was the pioneer in the development of the trolley car; and should this happen, we shall easily lead the world in the rapidity of our express service.

WATER-CURTAIN FIRE PROTECTION.

Water-curtain protection against fire has been applied to a building in the city of London. During a practical demonstration of the new system made before representatives of the fire insurance companies, its value was so clearly established that a material reduction was secured in the premium. The system is simple in construction and operation. Every outside wall of the building carries, near the roof line, a horizontal water pipe, which is perforated on its under side. These pipes are supplied by a vertical standpipe, and each line is controlled by a valve, which enables any particular wall to be protected by a flow of water, or not, as the exigencies of the fire may demand. In the case of the London building, the horizontal pipes are supplied from a main standpipe, which is under a pressure of 80 pounds to the square inch. Another system of spray pipes is so arranged that a sheet of water may be thrown laterally over the roof, thus rendering it possible to envelop the whole building in a practically continuous curtain of flowing water. The perforations are spaced so closely, and the pressure under which the water is discharged is so great, that the water curtain has proved to be amply sufficient to prevent the flames from passing through it, to attack the building which it shelters. In the particular building referred to in London, the system is supplied by a separate pump installed for the purpose in the building.

At the present time, when the city engineers are at work on the designs for a salt-water main system of fire protection in New York city, it would be opportune for the owners of costly buildings that are particularly exposed to the dangers of conflagration in surrounding buildings, to consider whether the installation of water-curtain pipes would not at once form an excellent protection against fire, and an effective means of reducing the fire insurance premium existing on those buildings. The salt-water main system involves the erection of central pumping stations, from which water at very high pressures will be available. Therefore, the expense to the individual property owner would be merely that of erecting one or more standpipes, and running around the building the necessary horizontal perforated pipes of the water curtain. It would not be necessary, as in the London building, to erect a separate pumping plant, for the reason that the central pumping plant would furnish the necessary pressure.

LOADS ON FACTORY MOTORS.

Average loads in factories are often thought to be greater than they really are. This is due to the assumption in many cases that steam engines work near their full capacities most of the time, though this is seldom true.

Uncertainty on these points often makes factory owners hesitate to contract for electric power to operate their machinery, even at rates that represent large savings over the cost of operating steam plants. It is easily seen, of course, that a rate for electric power that brings its daily cost above that of operating a steam plant, on the assumption that the average is nearly up to the maximum load, may bring the actual cost of operation much below that of steam, if the average load is only one-half or less than one-half of the maximum. A definite conclusion as to the probable average load in any case is all the harder to reach because the ratio of average and maximum loads varies much in different lines of manufacturing work. To illustrate these facts, the following examples of power and energy consumption in three distinct lines of manufacture are given, with the circumstances of each.

In a large factory devoted to the printing of fine cotton fabrics seven induction motors that ranged from 1 to 75 horse-power each and had a combined capacity of 346 horse-power were employed almost exclusively for this work. In order to operate the printing machines a speed with wide variations was necessary, and this was obtained by driving direct current dynamos with the induction motors, and then using current from these dynamos to supply motors that were direct connected to the printing machines. During 260 hours of regular working time at this factory, the consumption of energy by the seven induction motors of 346 horse-power aggregate capacity amounted to 26,461 electric horse-power hours. If these motors had been in continuous operation at full load during the 260 hours, they would have done $346 \times 260 = 89{,}960$ horse-power hours of work. As the actual consumption of energy by these motors during this time was only 26,461 electric horse-power hours, it appears that the average rate at which the motors absorbed electrical energy from the supply line was only $26{,}461 \div 89{,}960 = 0.294$, or 29.4 per cent of their rated capacity. It is to be noted here that the consumption of 26,461 horse-power hours included all losses in the motors as well as the mechanical work done by them.

Another case illustrating an entirely different line of work from that just considered was a large plant devoted to the construction of heavy machinery. During one month of 26 working days, or very nearly 260 hours of operation, this plant drew 77,000 electric horse-power hours from the supply line. At this time there were in use about the plant 21 induction motors that ranged from 10 to 100 horse-power each, and had a combined rating of 590 horse-power. If these motors had all been fully loaded during the 260 hours that the plant was in operation, their output would have amounted to $590 \times 260 = 153{,}400$ horse-power hours. As the energy actually consumed by the motors during this time was 77,000 horse-power hours, the average load which they took from the supply line was $77{,}000 \div 153{,}400 = 0.5$ nearly, or 50 per cent of their total rated capacity. Here again the figures given for the consumption of energy include all motor losses.

Still different conditions and results are presented by a third case, which was that of large mills engaged in weaving cotton cloth. In this case the motor equipment of the mills included 27 machines that ranged from 5 to 300 horse-power capacity each and had a total rating of 3,412 horse-power. This capacity was made up of induction motors for all except 200 horse-power in the synchronous type. During 273 hours of mill operation, this being the regular working time in a certain month, these motors absorbed 833,469 electric horse-power hours from the supply line. If all of the motors had operated continuously at full load during the 273 hours under consideration, they would have done $273 \times 3{,}412 = 931{,}476$ horse-power hours of work. As the actual consumption of energy reached only 833,469 horse-power hours in this time, it follows that the average power drawn from the supply system was only $833{,}469 \div 931{,}476 = 0.89$, or 89 per cent of the total motor rating, all losses included.

These three illustrations are taken from plants that were operating under normal conditions, and evidently cover quite a range of practice. The print works may be taken to represent approximately a large class of plants in which the demand for power is very intermittent, and in such cases it seems that the consumption of energy may drop to about one-third of what it would be if the motors were fully loaded during the hours of operation. In machine shops the rate at which energy is drawn from the supply line may be approximately equal to one-half of the rated power of the motors employed. As might be expected from the constant nature of the work, motors employed in weaving cotton cloth show an average power consumption well up toward their normal rating, in the above case 89 per cent.

If the average powers actually delivered by the motors in the above cases had been considered, their percentages of the motor capacities would have been smaller than those found above because there is a loss of energy in the motors themselves. The percentages as found, however, are what the prospective user of electric power most wants to know, because they approximately represent the ratios of his average consumption of power to the rating of the motors in use. In this connection it is well to have in mind certain facts relative to the rates usually charged for electric supply, and their relation to the net service which the customer actually gets. Lighting rates are usually made for electric energy delivered on the premises of consumers at a voltage suitable for the operation of lamps. Thus if the consumer uses 110-volt, 16-candle-power lamps that take 50 watts each, he can operate twenty of these lamps one hour for each kilowatt-hour of energy that he buys, because $50 \times 20 = 1{,}000$ watts. This takes no account of losses in the wiring of buildings which should not usually be more than 1 or 2 per cent. When it comes to electric heating the current from the supply lines will probably still be delivered at about 110 volts, and if the heaters are designed for a lower voltage the consumer may have to provide his own transformer. As there will probably be a loss of at least 5 per cent in the transformer, the heaters will get 3,438 heat units less about 5 per cent for each kilowatt-hour that is paid for. Electric motors are rated according to the power they deliver, not the power they absorb, so that an electric horse-power-hour of energy from the supply line cannot yield a horse-power hour of mechanical work. At full loads the efficiencies of good motors, both direct-current and induction types, range from approximately 75 per cent in the one horse-power to 92 per cent in the 100 horse-power size.

At partial loads efficiencies drop, but a mixed lot of motors, among which are some operating at one-half load, should have an efficiency of as much as 80 per cent. On this basis one horse-power-hour drawn from the supply line would yield 0.8 of a brake horse-power during one hour, or one kilowatt-hour from the line would yield 1.07 horse-power-hours, since the horse-power is 0.746 of the kilowatt.

A result of this motor loss is to make the cost per brake horse-power greater than the cost per electric horse-power from the line. Thus, if the motor efficiency is 80 per cent and the rate paid is two cents per electric horse-power-hour, or $60 per working year of 3,000 hours, the cost per brake horse-power is 2.5 cents per hour, or $75 yearly.

SCIENCE NOTES.

The Slaby-Arco-Braun system of wireless telegraphy is in use across Lake Baikal.

A new molybdenum compound has been discovered by Prof. Moissan. It is obtained by heating charcoal with melted molybdenum and aluminium in the electric furnace. The resultant metallic mass is treated with a concentrated solution of potash, says the Engineering and Mining Journal, and well-defined needle-shaped crystals of the new compound are obtained. The substitution is very hard, and resists all acids but nitric. It is not decomposed by water or steam at a temperature below 600 deg. C. It resembles tungsten carbide. It is hoped that the new compound may be useful in making molybdenum steels.

For some time past the scientific cultivation of the potato, i. e., the selection of the best and most fecund varieties for seed, has been in progress in Great Britain, and this year the experiment has been attended with highly successful results. One farmer, who has been engaged in several trials with new species, has this year lifted a tuber weighing 4½ pounds, while another has obtained a specimen of another variety weighing 4 pounds, 7 ounces. One farmer who planted 12 pounds of seed of a special variety has gathered in a crop of over 750 pounds. Investigations are now being carried out to obtain a "disease-proof" potato, as the predominance of disease wreaks considerable havoc among the crops, and is responsible for a heavy percentage of waste.

With reference to the suggestion advanced by the Hon. C. A. Parsons at the recent British Association meeting, that deep borings should be made into the earth's crust for the purposes of investigation of the earth's interior, and that a shaft such as this might be sunk to a depth of 12 miles, another scientist has pointed out that the pressure of the rock at such a depth represents some 40 tons per square inch and would render the task impossible, owing to the inward viscous flow of the rock material. In reply the Hon. C. A. Parsons suggests an experiment to solve the problem. He points out that the crushing stress required to make hardened steel flow lies between 120 and 300 tons to the square inch, while for tough brass or cartridge metal the flow is at about 80 tons per square inch pressure. His experiment would be to take a column of granite or quartz rock and carefully fit it into a steel mold. A small hole would then be bored through its center, and a pressure of 100 tons per square inch then applied, to observe what shrinkage would result. Such a pressure as this would correspond to that encountered at a depth of 38 miles.

The climate of Manchuria plays an important rôle in the war between Russia and Japan. Up to the present, we have had but little precise information upon this point. M. J. Ross has lately given some indications as to the climate of that region, and the character of the different seasons. He states that in the months of March and April there are strong southwest winds which bring with them heat and moisture. At the end of March the winter season ends. The under-soil is still frozen at this time, but the ground can be worked for agriculture. April appears to be the only month of spring. At the end of this month the sowing of wheat commences. Summer begins in May, and at the end of June or the beginning of July the wheat is cut. Up to the end of June rain is rare and the sky is generally clear, while cloudy weather is an exception. The heat reaches a maximum at the end of July and first part of August. Afterward come heavy rains or storms. It often rains for several days and nights without stopping. The soil is completely saturated and inundations are frequent. September is the harvest month, while October gives some of the finest weather of the year. At this time the heat is agreeable during the day and the sky is clear, with bracing air, while vegetation is at its height. At the end of the month the first night frosts begin to appear, and in November the cold weather commences and keeps up until March. At Mukden, the temperature sometimes goes down as low as —33 deg. C. During the day, however, the cold is not excessive, and sometimes in the middle of winter the sun's rays become very warm, on account of the southerly position of that locality. The maximum temperature of summer is 98.6 or 100.4 deg. F. About ten months of the year are dry for the most part, and the excessive wet season only occurs during a month or so. At Niutschwang, on the north shore of the Gulf of Liao-tung, the mean winter temperature is 16 deg. F., and the mean for the summer, 74.8 deg. The mean annual temperature is 47.1 deg. F. The Russian maritime provinces have a very low mean annual temperature. Thus at Vladivostock the average for the winter is 10.2 deg. F., and for the summer it is only 39.9 deg. F.

AUTOMATIC STEP-LADDERS.

Small inventions are not always the least useful, and a proof of the fact is furnished by the automatic platform step-ladders recently constructed by M. Bardin, of Billancourt, France. Since its invention in antiquity, the ladder, despite its manifold applications and manifold inconveniences, has scarcely changed in its general construction. It would seem, even, when we come to think of it, that it would be hardly possible to change anything in it. Such is not the case, however, as we shall see from the description of the Bardin ladder. This ladder, of which there are two types, of different size, one with steps and the other with rungs, is ordinarily double and composed of four uprights, hinged so as to fold together, and of a movable platform that is usually surmounted by a tool-box.

When folded, the platform lies flat along the steps of the ladder, and, when the latter is opened, slides to its proper position in two grooves so formed that at a given moment it is arrested and becomes more rigid in proportion as the weight supported by it is heavier. As may be seen, the mechanism is very simple. On the other hand, this new ladder has the merit of being extremely safe. There is, in fact, no danger of the sudden spreading of the uprights as a consequence of the breaking of the rope that keeps them in place. The equilibrium is assured by the platform itself. This latter possesses such stability that the person who has to stand upon it for some length of time can not only perform the kind of work that he has in hand with absolute safety, but also with as much facility as if he were stationed upon a scaffold. This is a great advantage for all joiners, locksmiths, plumbers, gasfitters, lamp-lighters, electricians, paper-hangers, painters, decorators and others who, through the exigencies of their work, are obliged to remain for a considerable length of time at the top of a ladder. Any one—man, woman, or child—can, in fact, stand erect and move about upon the platform with perfect safety, and that, too, so much the better because that, at the level of the hand, there is a box with a cover in which to deposit tools or other accessories, and the uprights form a guard rail at each side of the platform.

Ladder Arranged for Artists' Use.

Using the Platform of the Ladder Against a Wall.

How the Lamplighter Uses the Ladder.

The Artists' Ladder Folded.

Arrangement of the Ladder for Photographic Use.

How the Ladder is Carried.

The ladder, when folded, occupies no more space than an ordinary one. The platform fits into and entirely disappears in the space between the uprights.

The new ladder is adapted not only for industrial purposes, but in the country is capable of rendering great service in horticulture for the picking of fruit, pruning of trees, etc. It likewise very advantageously replaces rolling ladders, which are genuine war machines as expensive as they are inconvenient, and also simple or double ladders, upon the rounds of which a laborer, with an insecure footing and with his mind always preoccupied with the danger of a fall, works with difficulty and irregularity. There are some special forms of the ladder designed for artists, hunters, military men, lawn-tennis players, shop-keepers, bill-posters, book-sellers, photographers, and for use in store-houses, government archives, railway stations, etc.

GASOLINE-MOTOR-PROPELLED FIRE ENGINE.

BY OUR ENGLISH CORRESPONDENT.

A gasoline motor chemical fire engine has been constructed for Leicester, England, by the Wolseley Motor Car Company. Owing to the hard nature of the work which this appliance has to fulfill, the vehicle has been designed upon substantial lines. The chassis is built of channel steel of heavy section reinforced with stiff gusset plates and traverse members, riveted together. The wheel base is 9 feet 6 inches, and the track 4 feet 9 inches.

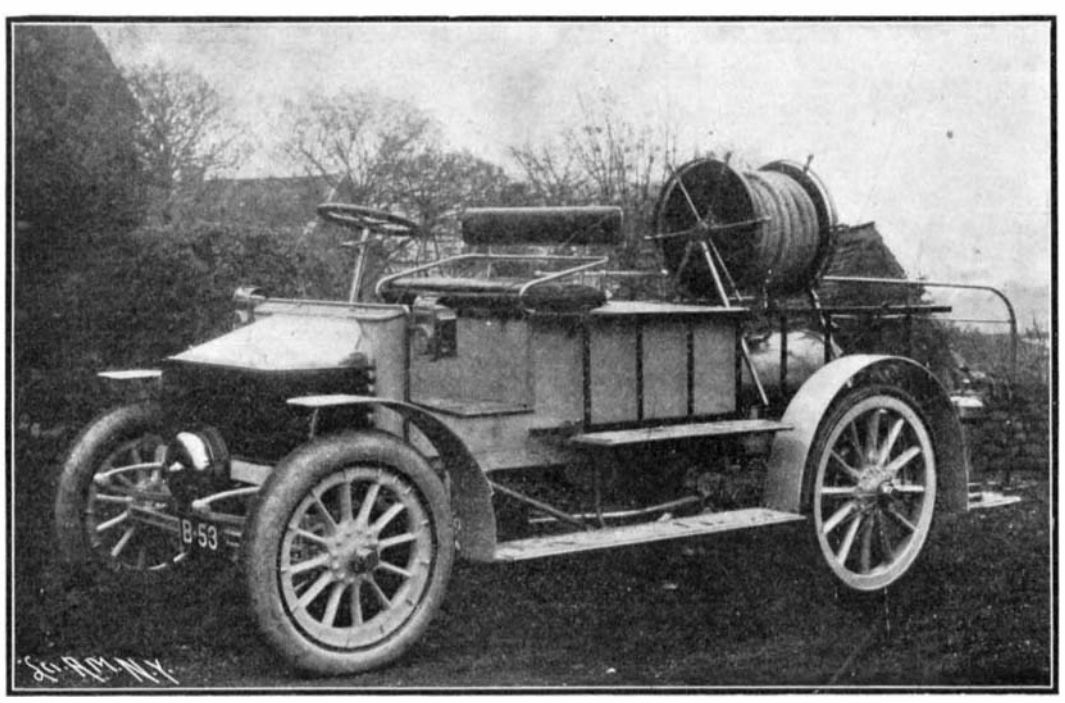
The wheels are of a special type. The rear wheels are slightly larger than the front, being 40 inches and 36 inches in diameter respectively. The wheels are of the wooden artillery type, but are specially reinforced with heavy wire spokes. The advantage of this arrangement is that not only is there additional strength in the wheel, but it can withstand very severe side strains, such as collisions with projections in the roadway, or the edging of the sidewalks, and the danger of collapse through rounding corners at high speed is appreciably reduced. The driving wheels are shod with heavy solid tires, while the front wheels are fitted with thick pneumatic tires to support the heavy weight of the vehicle. The wheel hubs run on plain phosphor-bronze bearings and the axles are made in one piece of best steel.

The car is driven by a four-cylinder horizontal engine, developing 24 horse-power, running at a normal speed of 750 revolutions per minute. A single float-feed spray vaporizer is employed, while the ignition is of the ordinary high-tension type with accumulators and trembler coil. Cooling is effected on the usual system, the water from the engine passing into a battery of flanged radiating tubes and being cooled by a current of air induced by a high-speed fan driven by the engine. The water then passes into the tank and thence to the engine.

Ample lubrication is effected from the dashboard to all parts. The change speed gear is of the general sliding type, a new pair of wheels being brought into action each time the speed is changed. Four speeds forward and one reverse are provided, the forward gear giving speeds of 7, 11, 15, and 20 miles per hour respectively. The transmission is through the ordinary cone friction clutch mounted on the crankshaft and connected by a chain to the gear-box. Chain drive from the countershaft of the transmission to the sprockets on the road wheels is employed. Adequate double-acting brakes, both foot and hand, acting on the drums cast on the sprockets of the road wheels, are provided. The gasoline tank has a capacity for 10 gallons. The chassis is constructed to carry safely a load up to 28 hundredweight and the total weight of the chassis is 20 hundredweight.

In the front of the engine is fitted a large double-beat alarm gong to give warning of approach along the streets.

The body is of substantial build, with seat in front for two men, including the driver, with a box seat at the back to accommodate two more on either side. At the rear of the chassis is a step for the accommodation of a fireman, and sufficient space for two first-aid chemical cylinders. Brackets are fitted on either side to carry a short ladder, while the equipment of the engine is completed by a chemical cylinder and hose reel.



CHEMICAL FIRE ENGINE PROPELLED BY A 24-HORSE-POWER GASOLINE MOTOR.

Count Zeppelin's New Airship.

Count Zeppelin's new airship is gradually nearing completion. It will be remembered that three years ago Count Zeppelin made experiments in aerial navigation which attracted much attention. Unfortunately, the experiments were not successful, and the Count lost a small fortune on the affair, the balloon and its accessories being eventually sold by weight in Germany.

Count Zeppelin, however, was not discouraged, and at once set to work to interest a financial syndicate to aid him. Many sportsmen also came to his assistance, and in two years $25,000 was subscribed in Germany toward the Zeppelin balloon fund, and several German manufacturers offered to supply the necessary materials at a low price or quite free of charge.

Then the Imperial War Office was approached, which at once placed materials and experts of the balloon department at the Count's disposal, it is said at the express wish of the Kaiser.

The King of Würtemburg is also taking the keenest interest in the enterprise, and some months ago went specially to Friedrichshaven to examine the works on the spot.

Although the cost will be nearer $50,000 than $25,000 to complete the airship, subscriptions are coming in freely, and there is no likelihood that work will be stopped owing to want of funds.

The new balloon will be somewhat smaller than the last one, which had a total capacity of 14,000 cubic yards and carried nearly three tons of water and ballast.

The motors to drive the airship will be much greater in force, their combined propelling power being eighty horse-power.

There will be two large cars attached capable of carrying eight to a dozen persons.

Now that the conversion of railroads to electric traction is rapidly taking place, involving in the majority of cases the laying of the third supply rail, it is desirable that means should be adopted to prevent employes coming into contact with the same. An ingenious protection for the live conductor rail has been introduced upon the market by an English engineering firm. The idea comprises a complete system of insulated protection for the live rail, unaffected by varying climatic conditions. Strong arched or semi-arched sections of metallic shields are attached to special insulating blocks attached to the live rail. These shields are fitted in lengths, so that in the event of an accidental contact, the current is confined only to the length of the part affected.

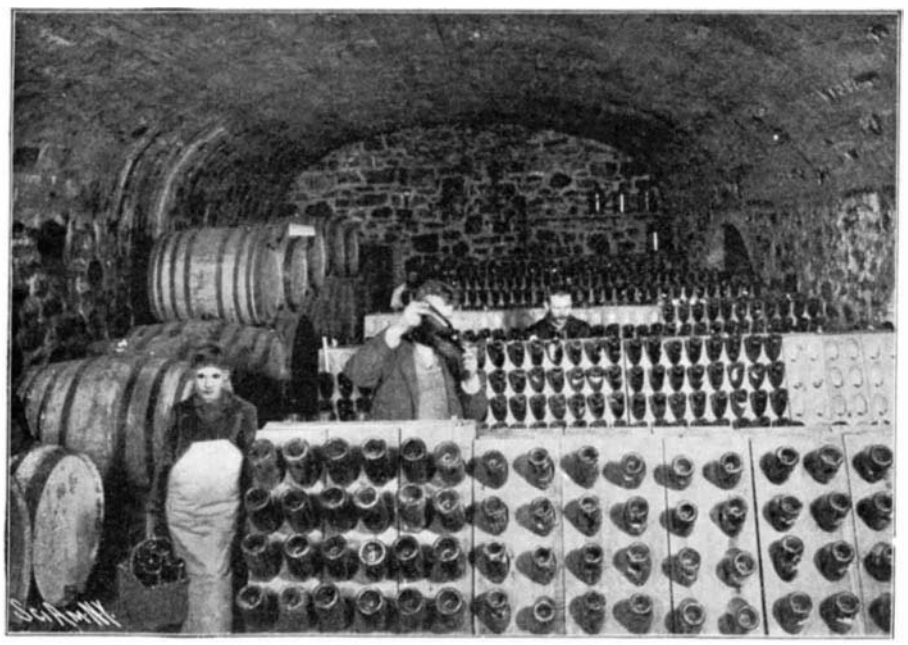
THE WINE-MAKING INDUSTRY OF NEW YORK STATE.

BY JOHN S. STEELE.

The wine-making industry in New York State is now in full swing. It began during the first week in September and will continue till late in the fall, or rather the preliminary process of pressing the grapes will continue until then. The other processes of wine-making continue over the entire year, and in the case of champagne, at least, which is the most important part of the New York State industry, the process of manufacture is not complete for three years. The making of still wines is completed as far as the active work of the wine maker is concerned when the fermentation is finished in the fall, but of course Nature's part, that of maturing the wine by age, may be extended indefinitely.

It is a fact not generally known that in some respects the wine industry of New York is the most important in the United States. The output of California is greater in quantity, and in value it exceeds that of New York. It is estimated that the average annual production of wine in California is between twenty and thirty millions of gallons, while that of New York is only from five to seven millions of gallons. In value, however, that of California is only about $5,000,000, while the wine output of New York is valued at about $3,000,000. This is explained by the fact that the California product is made up largely of clarets and Sauternes, whereas New York is the greatest producer of champagne in America, and champagne runs into value quicker than other wines. Absolutely, however, New York is second both in quantity and value in the United States, with Ohio third.

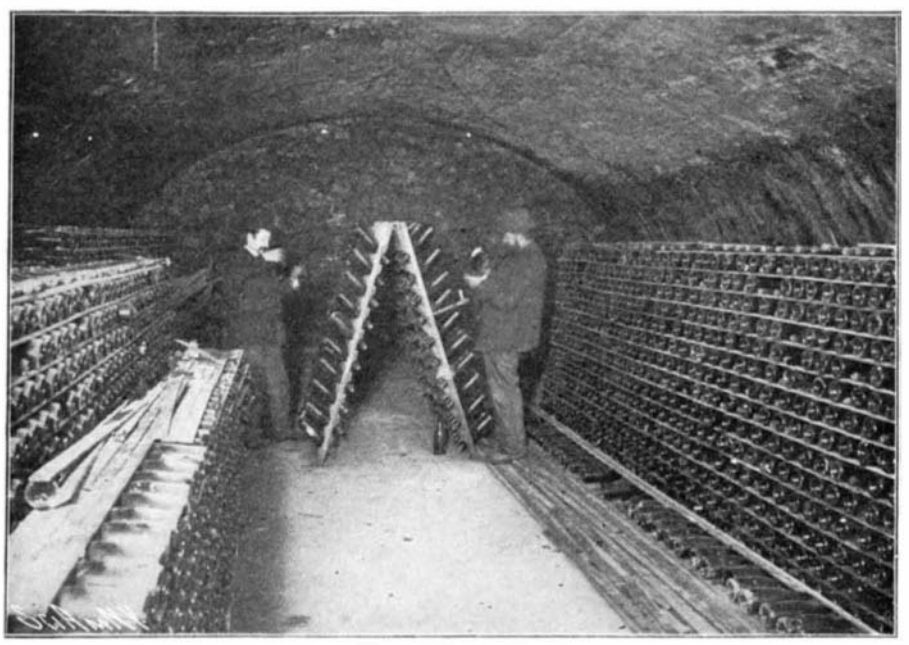
New York possesses the largest champagne plant in the country, and one that compares favorably with some of the famous European plants. There are regularly carried in storage there and in the process of maturing 1,500,000 bottles of champagne, and the regular annual output is about 250,000 bottles. All this



Classifying Champagne.

Wiring and Labeling Champagne Bottles.

Corking and Finishing.



Examining Champagne.

Shaking Champagne Bottles.

Disgorging Champagne.

THE WINE-MAKING INDUSTRY OF NEW YORK STATE.

wine is made from grapes grown in the neighborhood of Washingtonville and at Hammondsport, N. Y. About 400 tons of grapes are annually crushed to make champagne at this plant and an equal quantity for the manufacture of still wines. In the Hudson Valley alone there are 10,000 acres devoted to the growing of grapes for wine-making, and in the Lake Keuka district about 15,000 acres. In the whole of New York State there are about 50,000 acres under wine grapes. New York ports and sherries have taken their place in the market with the European wines. New York claret and Sauterne types are rapidly taking the place of the higher grade imported wines, and her champagnes, while handicapped by the popular prejudice against a native wine, are rapidly forging to the front.

The process of making champagne is an exceedingly intricate one, and one requiring a long training. A successful champagne maker must not only be an expert viticulturist, but he must also be a competent chemist. Champagne is not the product of any one grape. It is a blend of the juice of several varieties, and as the constituents of these grapes vary in different years, they must be combined each year in varying quantities to produce a uniform and perfect wine. The grapes used for champagne making in this State are the Elvira and White Diamond, which are white grapes, the Dutchess, a black grape, the familiar red Delaware, and the Eumelon, which is a dark grape. The juice of these is expressed separately in the fall, allowed to undergo the first fermentation naturally, and then allowed to rest in immense casks until spring. Then the juice of each is analyzed, in order to determine the proportions of each needed to produce the perfect blend. In their separate state they are known to the wine makers as champagne wines. A perfect champagne should contain about ten per cent of alcohol, seven-tenths of one per cent of tartaric acid, two to three per cent of sugar, and the rest the water derived from the natural juice of the grape. In seasons like the present when, owing to a cool and wet summer, the grapes are watery and deficient in natural sugar, it is sometimes necessary to add a little pure cane syrup to the wine to bring up the percentage of sugar. In all cases the sweet wines are produced by the addition of sugar. The dry wine is a natural champagne. When the right proportions have been determined by a chemical analysis of the champagne wines in the spring, the blend is made and the wine bottled. It then enters upon the process of fermentation in the bottle, which is the distinguishing characteristic of true champagne. Many cheap sparkling wines are made sparkling by charging them with gas. The gas in champagne is developed by the fermentation in the bottle. This process takes about three years. The bottles, tightly corked and secured with thick wires, are piled one on top of the other in stacks containing thousands of bottles, in a moderately warm cellar. There they remain undisturbed until the fermentation is complete. The only means that the maker has to know when this is so is by the breaking of the bottles on account of the enormous pressure of the gas developed in the fermentation. About five per cent of all champagne made is lost by this breakage, and often whole stacks of bottles are shivered before the process can be checked. When the breakage becomes so great that it is evident that the fermentation is complete, the bottles are removed to a cooler cellar and there set out neck down in slotted tables for the final process of clearing. The object of this is to allow the sediment in the bottles to settle on the corks, and to facilitate this settling each bottle must be shaken twice a day for a period ranging from fourteen days to a month. A force of forty men is employed at shaking bottles during the season at Washingtonville.

When the settling process is complete that of disgorging follows. The wire is removed and the cork with the sediment resting on it is expelled by the pressure of the gas. If the wine is to be dry the bottle is then filled with a little old champagne, and if it is to be sweet a dosage of cane syrup is added. The bottles are then finally corked and labeled and are ready for the market At this stage the wine is in fair condition. It improves for about two years after bottling, when the improvement ceases and it is liable to deterioration.

The other types of wine made in New York State are determined by the kind of grape used, and to some degree by the manipulation in making. Sherry is made from the Folle Blanche grape and is aged in a heated room. Tokay is made from the old raisin grape and is a perfectly natural wine. It improves indefinitely with age and does not acquire its best qualities until it is about twenty years old. Clarets and Sauternes are the simplest types of wine and are made from various types of grapes.

Nearly all the American types of wine grapes have been developed from the American wild grape. It is a fact well known to viticulturists that seedling grapes are seldom true to type. Half a dozen seeds from one berry will, if planted, produce probably as many different types of grape, and the chances are that they will all be worthless. The valuable types are all propagated by cuttings, which always remain true to the parent type. Viticulturists are constantly experimenting with seedlings in search of new varieties, but if they obtain one of value from a thousand seedlings they consider themselves fortunate. Many of the most popular varieties have been discovered by accident.

Automobile Notes.

A curious automobile is said to have been invented by a Russian engineer, Konstantinoff, in the shape of an auto-sleigh combined with a boat. Prince Khilkoff is to use it to cross Lake Baikal, and it can run over the ice or in the water. Its form resembles that of a boat, below which are set two steel bars which serve as runners. The sleigh is propelled by a wheel driven by the gasoline motor, the wheel having points in order to grip on the ice. When the boat is in the water, the motor is connected to a propeller by a clutch.

A mill is being equipped in Lancashire, England, for the manufacture of cotton automobile tires by means of a new American machine. With this apparatus the tires are woven in much the same manner as cotton wick for lamps. The tire is continuous and endless, and of the form and shape of the wheel, thereby enabling fitting to the wheel to be carried out with facility and celerity. The tire has a greater bursting strain than any other material from which tires are at present made, being equivalent to 6,000 pounds per square inch. By means of this machine a tire can be turned out complete in thirty minutes.

An important and extensive development of transport by automobiles has been inaugurated in middle and southern Italy. The present horse diligence service is considered too lumbering, costly, and slow in comparison with motor vehicles. The type of car which is to be introduced upon the new system is the "Pipe," the well-known Belgian car. Contracts have been placed for the supply of 600 Pipe chasses fitted with 20-horse-power motors, together with 300 wagon and 300 omnibus bodies, so that one-half of the consignment will be available for the transit of freight, and the second moiety for passenger traffic. The bodies are, however, to be made interchangeable, so that, if necessary, a car can be converted from one type to the other in about half an hour. The omnibus vehicles will have accommodation for 10 or 12 passengers, and the freight cars for two tons of merchandise. The scheme is being organized by the government and the various municipal corporations that will be concerned and benefited by the service. The roads are to be overhauled, corners eased, bridges of substantial construction erected at necessary crossings over ravines, and other improvements carried out. The system will be operated upon similar lines to a railroad, with stopping places at certain intervals, where the municipal authorities will establish open waiting rooms. The first route is to be opened in January next, and the succeeding services as rapidly as the necessary arrangements can be completed.

The modern motor car has found its way into the White Mountains, and from all parts of New England, from New York, and New Jersey, and even from the Middle West, it is being headed toward that picturesque section of New England. Early in the season the horses were very much afraid of it, as previous to this season it was a comparative stranger. At Bretton Woods stables, where there are more than one hundred horses, the experiment was tried of bringing the horses in contact with cars of various types, until they became thoroughly acquainted with the fact that the machines would not injure them. Mr. J. F. Hathaway, of West Somerville, was the auto-philanthropist who took upon himself the task of bringing horse and motor into harmony. His first move was to drive his car into the stables, causing at first a great deal of commotion, some of the horses being so frightened that they lay down in the stalls; but with daily schooling and coaxing, most of them were soon induced to eat oats and sugar from the machines, and some of the best pupils came to this within one hour's time. It took careful and painstaking work for a few days to get them accustomed to the cars under all circumstances. The results have fully compensated the teachers for their efforts, as there has not been the slightest accident to any person, horse, or vehicle. This is the more remarkable in view of the great amount of driving and riding at Bretton Woods, the record for the eight days, August 21 to August 28 inclusive, showing 496 horses let to guests at Bretton Woods. In this equine school were fifteen spirited saddle horses that were ridden by the hotel guests, many of whom were never in a saddle until they came to Bretton Woods.

A water tube boiler has recently been designed on the counter-current system, in which the gases produced in a refractory lined furnace are caused to travel spirally down the length of the boiler tubes while water ascends the tubes in which spiral retarders are placed.

Engineering Notes.

An extensive subway system for Chicago is under contemplation, and the preliminary plans for lowering the street-car tunnels have been submitted.

A powerful cableway has been built to carry the necessary material across the river at the Victoria Falls for the bridge and permanent way. The bridge is expected to be completed by the end of this year, and the section to Kalomo, 150 miles in length, a few months later.

About 1,010 tons of steel were used in the construction of the coal storage plant for the New York navy yard, which it cost approximately $16 per ton to erect. The driving of the field rivets was the most expensive part of the work, the average cost being about 25 cents per rivet.

For protection of an iron pipe, dipping it in liquid asphaltum, rather than coal tar and pitch, is advocated. The variety of asphaltum obtained as a by-product from the California oil wells is cheap. A pipe thus coated was laid for conveying salt water, and after six years was found to be still bright, not having been attacked either inside or outside.

A new system of laying asphalt roads is being adopted in London. Instead of paving the road with one homogeneous mass of the paving material, which means the closing of the thoroughfare for a prolonged period, the asphalt is laid in slabs, in the same manner as paving stones. The asphalt slabs are previously hardened, so that all it is necessary to do is to lay them down on the prepared foundation, and cement them into position with tar. By this system a road can be reopened for traffic as rapidly as it is paved, while a further distinct advantage is obtained, as owing to the use of the tar at the joints, the surface of the roadway is less slippery than in the case of large unbroken stretches of asphalt paving.

As already notified in these columns, the British Admiralty has decided upon the utilization of liquid fuel for the propulsion of naval vessels, and the application is being adapted to the larger as well as the smaller craft. The after boilers of the battleship "Prince George" have now been fitted with oil-burning apparatus, and the necessary tank accommodation for storing the oil. The reservoirs for the latter are in the double bottoms, provision for 400 tons of oil having been made. The Admiralty, however, does not intend to supersede coal entirely by liquid fuel, but rather to utilize it for auxiliary or emergency purposes, such as when the coal is running short, or it is necessary to raise steam quickly.

A series of trials, which will prove of great value to marine engineers, concerning the weight of steam used in turbine and reciprocating engines respectively, are to be carried out by the British Admiralty. Two torpedo boats, one of which is fitted with Parsons turbines, and the other with ordinary reciprocating engines of the latest type, are to be employed for the purpose. Both these vessels are fitted with Yarrow water-tube boilers, and the boats are practically sister ships. Measuring tanks are fitted to the decks of each vessel. The condensed steam will be pumped into each of these, and carefully measured. By this method an approximate comparison of the relative economy of the two systems of propulsion will be obtained, for it will be possible to ascertain the actual weight of steam passing at any stated periods, such as an hour, through the machinery. Every care will be observed to render the records as accurate as possible, so that a practical estimate may be obtained.

The completion of the recently sanctioned railroad up Mont Blanc will signalize the highest railroad in the world. The franchise for this achievement has been granted by the French government to Messrs. Deraud and Duportal, two well-known engineers. The railroad will have its lower terminus at the town of Fayet, and climb the southern slope of the mountain range to the summit three miles above. In the design of route to be followed by the railroad, special attention has been paid to scenic effect for the edification of tourists, so that magnificent Alpine vistas may be obtained from all of the stations. Owing to innumerable engineering difficulties in the scheme, the railroad will follow a tortuous route. Also owing to the necessity of enabling passengers to become accustomed to the gradually rarefying atmosphere, the speed of ascent will only be equivalent to a horizontal speed of one mile an hour, so that the entire journey will occupy four hours. The railroad will be electrically operated, the necessary motive power being supplied from the mountain torrents and waterfalls abounding in the district. Twelve round trips a day will constitute the service, and in the event of the electric power failing, powerful gasoline cars will be retained, in readiness to resume the service until the electric fault is repaired. The round trip will cost $4. The construction of the railroad is estimated to cost $175,000,000. Each section of the railroad will be opened for traffic as soon as completed.

Correspondence.

The Advertisements in the Subway.

To the Editor of the SCIENTIFIC AMERICAN:

Allow me to express appreciation, from a bacteriological standpoint, of your recent editorial condemning the devices set to accumulate dust and dirt in the Subway stations.

It seems incredible that at this time, just when the city has appropriated a large sum of money to investigate respiratory diseases, a condition such as that represented by the Subway stations should be allowed to exist. The Subway under the best of conditions will be a good lurking place for disease bacteria, and every possible means should be used to prevent this.

The more modest of the citizens who practice the filthy habit of spitting will use these Subway ornaments to hide the evidence of their uncleanliness and each one may become the focus for the dissemination of respiratory disease.

When future generations come to a better knowledge of conditions influencing the spread of disease, they will have to acknowledge a debt of gratitude to the press that is now doing so much to aid science in the adoption of the right kind of hygienic laws.

ROBERT J. WILSON, M. D.,
Instructor in Bacteriology.

The University and Bellevue Hospital Medical College, New York, November 3, 1904.

Vacuum Tubes.

To the Editor of the SCIENTIFIC AMERICAN:

In some recent experiments the writer was astonished to find that a vacuum tube could be made to glow without the use of apparatus. This fact, perhaps familiar to some, will be new to others, and being easily demonstrated, seems worth describing.

If an ordinary incandescent electric light bulb or a Crookes tube or radiometer tube is subjected to rapid friction with the hand, it will be found that the whole interior of the tube glows with a faint, bluish light. The light lasts only during the actual friction against the tube, fading out almost instantly. It does not matter how the tube is held, the only condition being that the motion shall be rapid and light, several times a second, the hand leaving the tube after each stroke. The glow fills the whole interior of the tube, but is usually more intense at the point of rubbing. The condition of the atmosphere, the matter of insulating or grounding the tube, heat and cold, have no apparent effect upon the light. Of the various substances used as rubbers nothing was found to answer better than the hand. The intensity of the light depends to some extent upon the state of the vacuum, as some tubes respond more readily than others. Tests with the photographic plate show that the light possesses but feeble actinic power. In order to see the glow it is necessary that the room be absolutely dark.

The existence of the light probably depends upon the production of electricity, although its apparent indifference to atmospheric conditions, insulation, heat and cold, is difficult to reconcile with this view.

Media, Pa., October 11, 1904. C. M. BROOMALL.

THE ANCIENT RACES OF YUCATAN AND MEXICO.—I.

BY RANDOLPH I. GEARE.

Judged from the standpoint of mystery, it is no wonder that the history of the ancient American races which occupied Yucatan and the territory to the south and west, and built cities, such as Mitla, Uxmal, Chichen-Itza, Palenque, and hosts of others, whose ruins are still in some instances substantial evidences of a high degree of civilization, has excited the interest of the greatest archæologists of the United States, of Spain, of England, and of other countries. Their explorations have produced most valuable results, and numerous books have been published describing these ruined cities and the principal buildings which they contained. For this reason the present article will not deal, save incidentally, with the ruins, but will be devoted chiefly to a discussion of the history and manners of the builders.

Numerous theories have been advanced as to the origin of the three great original American races, namely, the Mayas, who occupied Yucatan and Chiapas; the Nahuas (or Aztecs) who settled in the Valley of Mexico; and the Zapotecas, whose home was in Oaxaca. The early Greek historians believed that over the middle portion of what is now the Atlantic Ocean there was once a broad continent, called Atlantis, inhabited in early days by a highly-cultured race of people, who gradually but persistently extended their sphere of occupation until at last the gods became angry with them, and punished their greed for territory by submerging Atlantis beneath the waters.

However this may be, it is certain that into this strange and (comparatively speaking) newly-begotten land, pioneers of the red race found their way; and, attracted by the fertility of the land, as well as by the presence of the numerous huge natural wells which seemed to lead down into the very bowels of the earth, built themselves habitations. Here they prospered and multiplied; and as they were comparatively isolated and free from interruptions, went on from century to century building cities and developing their various arts, until in time each great well or group of wells was enriched with temples and palaces, grand in proportions and rich in unique though barbarous sculptures. For a long time comparative peace prevailed, and the several communities seemed welded together in a strong and permanent union—the first United States of America! But the rapid development of many centers of culture and power led to jealousies and feuds; and from native sources it has been learned that only a few decades before the arrival of Columbus disastrous wars ensued, depopulating many districts altogether, and reducing the cities to ruins. Then it was that the strong impetus toward culture of these remarkable people, who had passed through all the gradations intervening between a savage and civilized race, weakened, and the contentions of numerous chieftains, pitted against one another, dissipated the essential elements of national strength. It was at this juncture that the Spaniard appeared upon the scene with his warlike fleets, seeing which the warring and partly scattered tribes once more became reunited, and a bold, common system of defense was organized. Though largely superior in numbers, however, they were entirely unable to withstand the assaults of the Europeans with their improved modes and weapons of warfare, and by the force of the gun and the horse Spain easily secured a permanent foothold, which otherwise probably could not have been obtained for centuries, if at all.

The natives declare that the whole of Yucatan, and indeed the greater part of Central America, was at one time ruled over by one king, and that it was then called "Maya" or "Mayapan" (banner of Maya). In very ancient times the peninsula was known as Mayax, or the "first land."

The Maya language is still spoken more than the Spanish by the natives of Yucatan, of Peten, in the northern part of Guatemala, in the Lacandon country, on the shores of the Unmacinta, and in the valleys of the region called "Tierra de Guerra."

As a rule the Mayas were dignified, grave, and somewhat inclined to melancholy, yet some of them were very witty and clever jesters. The women were pretty, and lighter in color than the men. They were loving and lovable, exceedingly modest and industrious. It is said that even now no Yucatan Indian is ever rough or clumsy. They are scrupulously clean, in marked contrast to the aborigines of Mexico. Both sexes wore white cotton garments, those of the women being ornamented with colored embroidery. Some of the men wore handsome cloaks, made of stuff resembling fine damask of many hues.

There were Maya colleges for both sexes of the higher class, and also convents. The nuns lived like the Roman vestal virgins, and any of them who failed to keep their vows were killed with arrows. The high priest, however, if so desired, could sanction a vestal leaving the convent and marrying.

The young men were treated with much severity. It was considered disrespectful for them to amuse themselves before their elders, so public buildings were provided where all the youths congregated for recreation, including athletic sports, acting, singing, and dancing.

One of the most remarkable discoveries by the Spanish priests concerning the ancient Maya religion is that they practised baptism and confession. The baptismal rite was called Zihil (to be born again), and was celebrated when the children were between three and twelve years old. It consisted in part of sprinkling them with water. As to confession, husband and wife told their sins to each other, which afterward were made public, so that all could implore their god Ku to forgive the offending one. They believed that when they died, they went to a place where they would suffer for their sins, progressing later to a happy state, and that after a lapse of time they would again be reincarnated on this earth.

The Mayas were not formerly idolaters, although ages ago they regarded the mastodon as fit to represent a god, because it was the largest and most powerful creation known to them. But it was only a symbol, and was not regarded as a real god. They also adored the sun as the source of all light and heat, hence their worship of fire as emanating from the sacred orb. They believed in one unseen, incomprehensible power (Ku). The present Mayas, on the other hand, are quite different. They are idolaters, and have blind faith in wooden saints or images, before which they devoutly say their prayers.

The ancient Mayas expressed a loathing for eating human flesh, and they hated the Mexican Indians because they practised cannibalism. Nor is there proof that they made cruel sacrifices of human beings, although some of them, with the hope of gratifying their deity, would voluntarily throw themselves into one of the large natural wells (*Senote*), firmly believing, however, that on the third day they would rise again. This is certainly significant, as it hints at their belief in the resurrection of the body—a doctrine commonly ascribed only to the Christian faith.

At the time of the Spanish conquest, the lower classes of the Mayas practised inhumation, the grave being in or at the back of the house. The mouth of the corpse was filled with corn and some money, consisting of tiny copper bells and bright red stones. With the body was placed some article indicating the calling of the deceased, and some provisions. They were buried lying at full length, but one tribe, dwelling between Guatemala and Chiapas, doubled up the legs and brought the face into contact with the knees, binding the body and placing it upright in a round hole.

When the Spaniards took possession of the land, the Mayas were still a populous nation, numbering not less than two million souls, although at the present they are believed to have decreased to about one-fourth of that number. In the northern part of the land they still occupy there has been much commingling with Spanish blood, while in the interior there are yet some tribes that have never yielded their independence, and still oppose the approach of white men.

The only existing witnesses of their former greatness consist of ruined temples, palaces, and other national buildings; in fact, the Maya territory, which now occupies some seventy thousand square miles, is literally dotted with the ruins of towns and large cities, which were once teeming with life and activity. They had their arts and industries, too; and their books, of which many examples are to be found in European libraries, give evidence of much skill in glyptic and pictographic writing. They also had a system of time-keeping, which was so accurate that they are believed by some to have borrowed certain parts of it from eastern countries. They also had and still have a well-developed language, which in grammatical construction is said to resemble English more than any known American tongue. In commercial and agricultural pursuits they were eminently successful, trading with Cuba and many other ports, perhaps including Florida. Their textile and ceramic arts, says one writer, were practised with especial success, certain varieties of earthenware obtained from the southern Maya areas ranking among the highest work of its class in America. Thus it is evident that the Mayas were not an ignorant, enslaved race, but rather a people endowed with a high mental order as compared with some other native stocks.

In appearance the Mayas of to-day are dark, sturdy, and short, and in general may be said to possess the usual characteristics of the red race. One writer says that while their origin is largely a matter of conjecture, one account of them connects them with the history of the god and culture-hero Itzamna, and derives an important division of the race from the East, where, as already hinted at, they are said to have come across, or rather through, the area now occupied by the waters of the Atlantic Ocean.

It is worthy of note here that, however striking may be the parallel between the Mayas and the Aztecs in arts and customs, their languages are quite distinct, and the similarities between them are probably due to the fact that in the course of their history the Mayas were at times in contact with the great tribes that inhabited the Mexican plateau. "Indeed," writes Mr. Holmes, "all may have had a common origin to the north of Mexico, or even beyond the Rio Grande." It seems certain, at all events, that the Mayas were from the standpoint of culture ahead of all other American tribes, and although barbarians, in the strict sense of the word, were still on the border of a high civilization. Unlike savages, they had a system of keeping records, and were probably the only race on this continent that had made headway in developing a phonetic system of writing. Thus, their hieroglyphs, which have lately received much attention, and regarding which a very interesting paper by the well-known archæologist, Dr. Cyrus Thomas, is being published in the Report of the Smithsonian Institution, occupy a place somewhere between pictographs and letters, so that a distinct period of literature was actually dawning in America when the advent of the Spaniards permanently interrupted its progress.

(To be concluded.)

The Carnegie Institute of Washington has just issued a pamphlet containing an account of a new method of determining compressibility by Messrs. T. W. Richards and W. N. Stull. Bromine, iodine, carbon tetrachloride, chloroform, bromoform, water, and mercury have been examined. In the case of a substance like bromine, the liquid is hermetically enclosed in a very thin, flexible glass bulb, and subjected to compression under mercury, correction being made for the change in volume of the mercury and the glass. A new form of high-pressure manometer has been devised, the working of which depends upon the difference between the compressibility of water and mercury.

JAPAN AT THE ST. LOUIS FAIR.

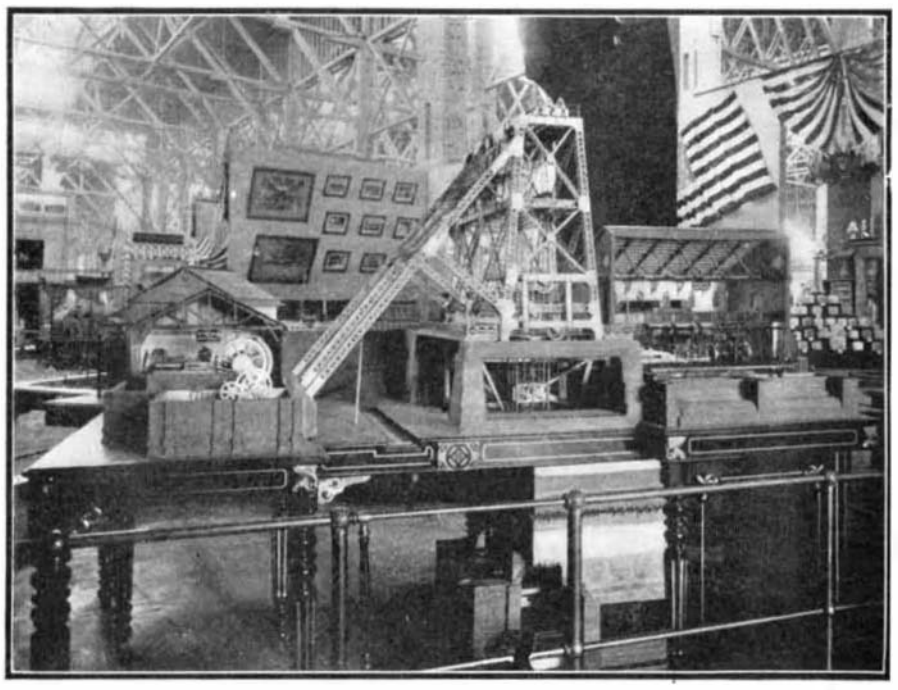
BY THE ST. LOUIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

It is a strong tribute to the self-reliance and resources of Japan that, in spite of the war for existence which hung over her head, she should have carried through her plans for an exhibit at St. Louis costing over $1,000,000. The most picturesque part of Japan's representation is found along the terraced hillside covered by the buildings and gardens of the imperial government, and in the exhibit known as "Fair Japan," where her quaint customs and interesting ways are enacted by hundreds of living Japanese types.

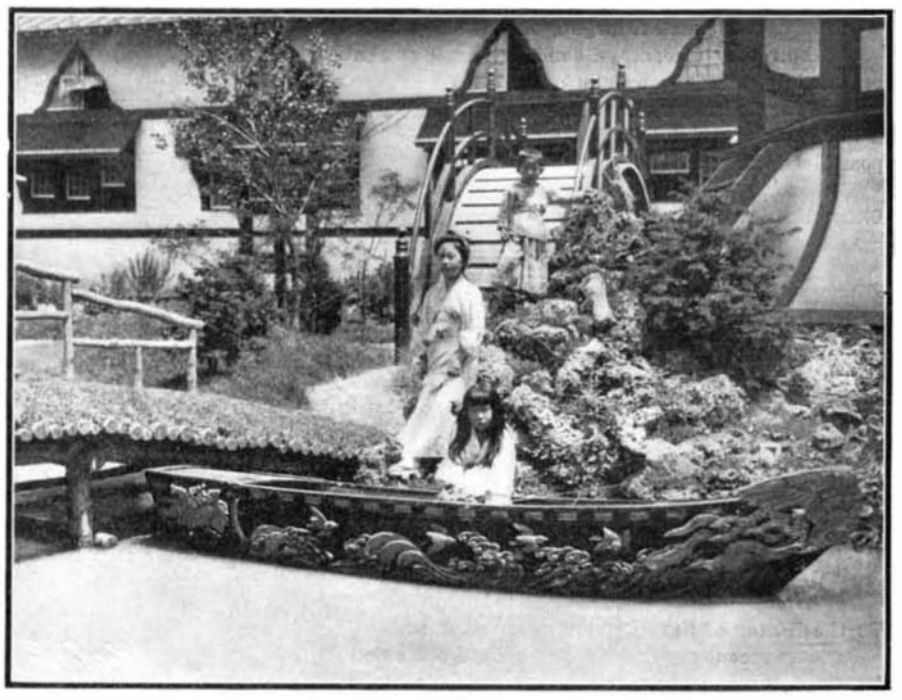
At the gateway leading to Fair Japan is a perfect reproduction of the great entrance to the famous Temple of Nekko, built centuries ago by one of the rulers of Japan. This beautiful temple was decorated with gold and lacquer and carvings of the most famous artists of the time. The temple is one of the most noted types of Japanese architecture at Nikko, the Mecca of art in the island empire; hence there is an old proverb to the effect that nothing can compare in beauty to Nikko.

In the pavilion grounds are the Japanese administration building, where the commissioners make their headquarters; a reception hall, where the Japanese receptions and banquets are held; and two public tea-

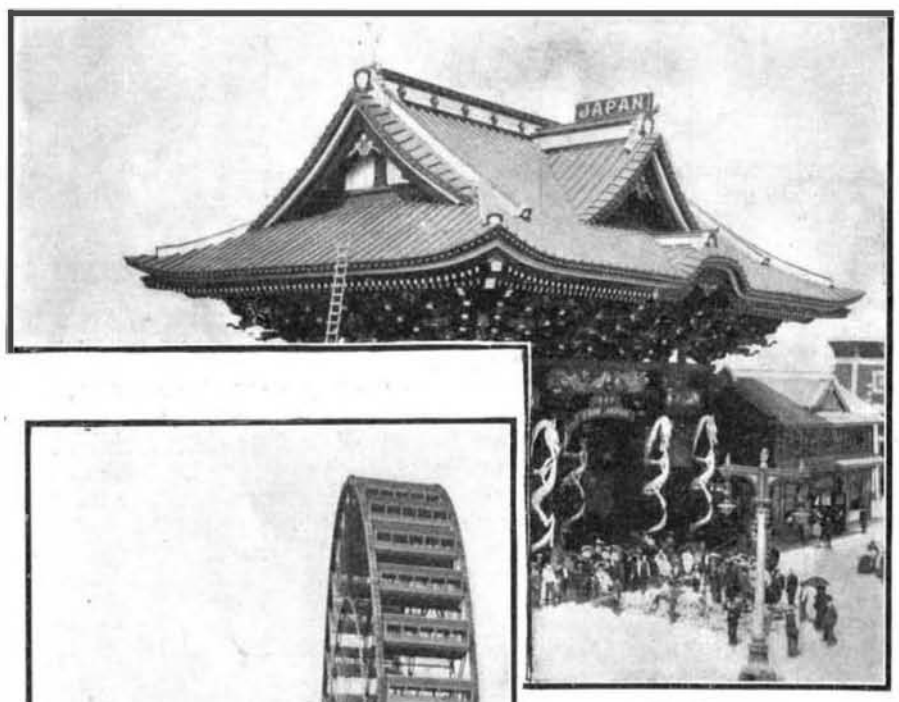
(*Continued on page* 378.)



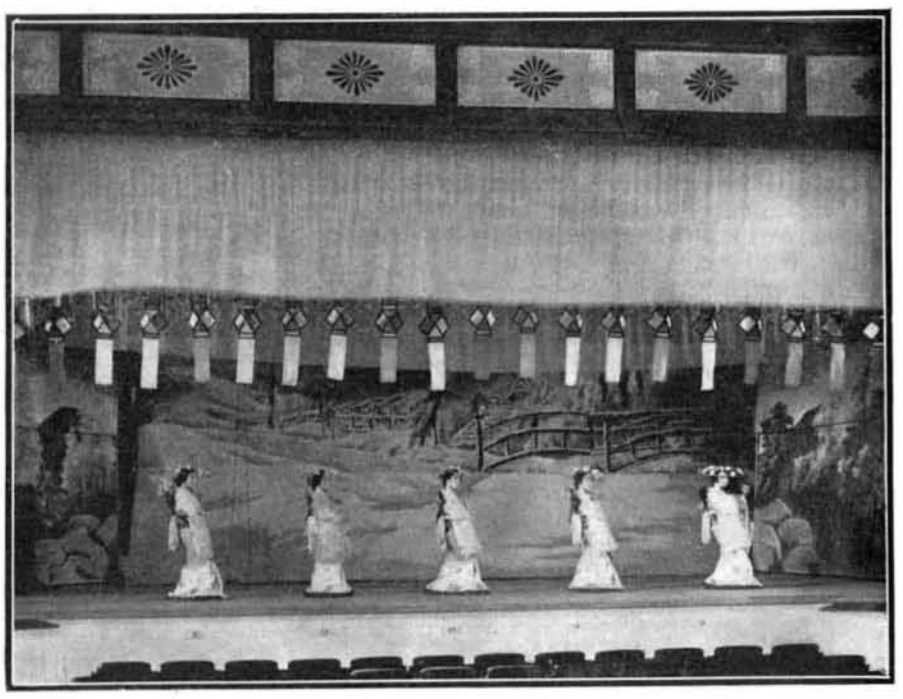
Working Model of a Japanese Colliery, Mines and Metallurgy Building.



Native Boat and Rustic Bridge in "Fair Japan."



The Nikko Gate.



Scene in the Japanese Theatre in "Fair Japan."

Photograph copyright 1904 by Louisiana Purchase Exposition Company.

Japanese Government Pavilion and Gardens.

JAPAN AT THE WORLD'S FAIR.

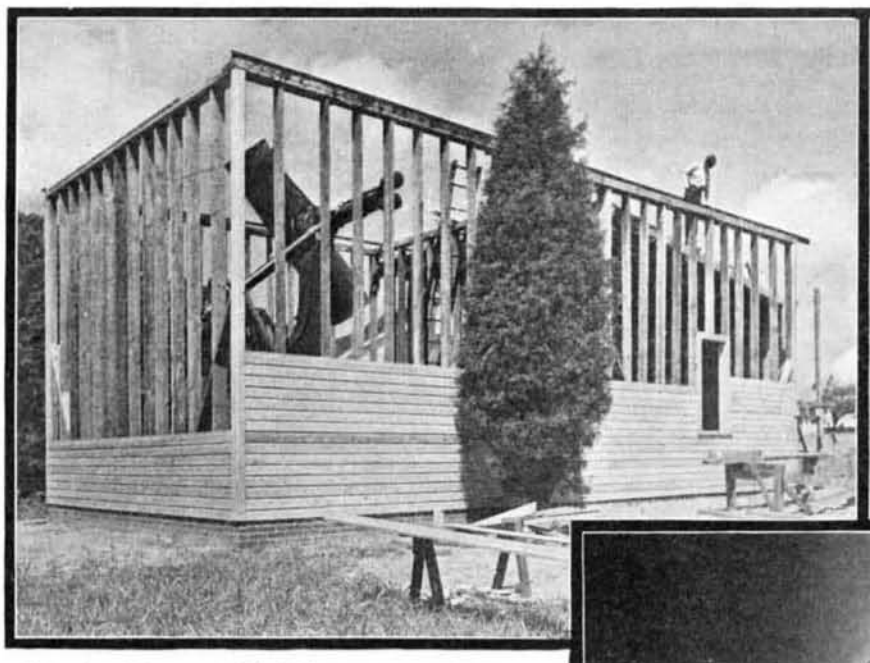
THE NEW ASTEROID CAMERA AT THE UNITED STATES NAVAL OBSERVATORY.

BY C. H. CLAUDY.

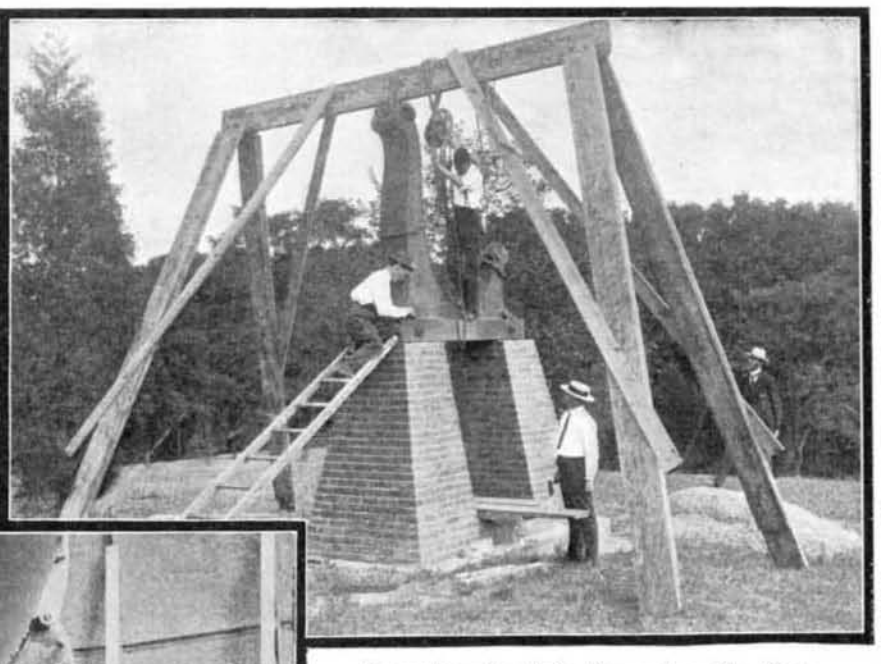
It is somewhat difficult for the layman to understand the uses and necessities of some of the more obscure departments of astronomical work. Of what use, he asks, is the accurate determination of the parallax of some small and faint star, or the plotting of the orbits of some of the asteroids? But things astronomical, like things terrestrial, have a fashion of depending very much upon each other; and to continue the instance just mentioned, the accurate measurement of the solar constant, most important to navigators, depends upon a great many factors, of which asteroid observations, or at least observations upon Eros, the nearest of these little bodies, is not the least important.

As everyone knows, asteroids are tiny little planets revolving about the sun between the orbits of the major planets Mars and Jupiter. Foreshadowed by Bode's law, now discredited, hunted for by an association of astronomers, the first asteroid was discovered by an independent observer, who called his discovery Ceres. Now there are several hundreds of the little bodies known, but as others are constantly being discovered, the field is not yet closed. Of course, all the brighter ones, and consequently the largest and most important, have been discovered, but the little ones present problems of interest not to be despised. The old way of setting about discovering an asteroid was to compare a suspected region of the sky with a chart, and if anything was to be seen not on the chart, to observe it for movement. This was a tiresome, tedious, and not particularly reliable operation. Now the astronomer turns his heavenly camera on the sky, and when he finds a small trail or line on the plate, instead of a point, he knows that the particular heavenly body which made that trail was within the planetary system, and consequently an asteroid.

At the Naval Observatory, Washington, there has been in use for some time a camera with a nine-inch lens, attached to the great equatorial telescope. Of course, when the camera is being used, the great instrument is out of commission, only the mechanism which moves it being used. For it should be clearly understood that taking pictures of the stars is an affair of some time, exposures of from one to three hours being given. During this time, of course, the earth is turning about its axis, and the stars are traveling across the heavens from east to west. So it is necessary to keep the camera moving with the stars, or all of them would make trails, and the value of the observation be lost. This keeping the camera in motion toward the west as fast as the earth turns to the east is accomplished by having the instrument mounted equatorially, or, as in the present case, attached to some other instrument's equatorial mounting. An equatorial mounting, be it understood, is one which has two axes, one in the plane of the earth's axis, the other in the plane of the earth's equator. The polar axis is revolved at a speed which would carry it around once in a sidereal day, so that it exactly compensates for the motion of the earth around its axis.

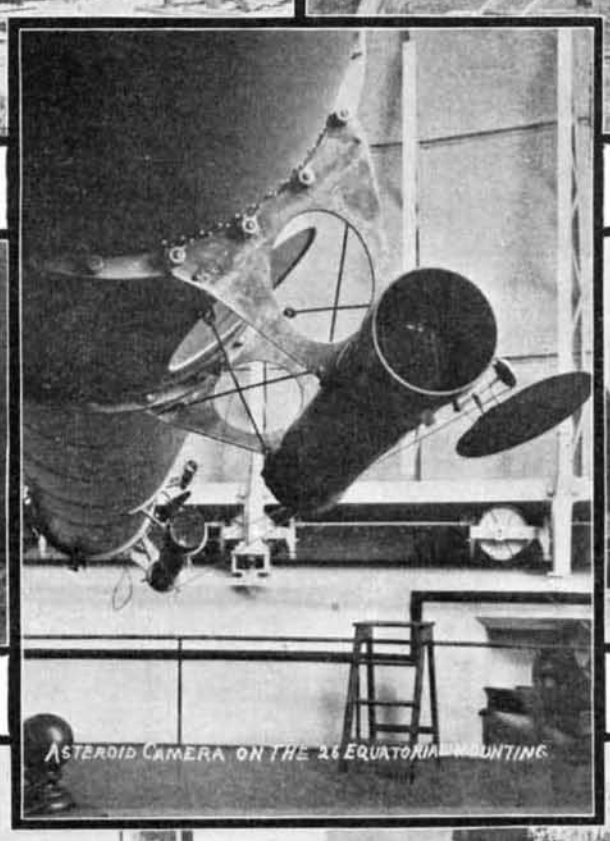


Erecting Photographic Telescope and Shelter.



Lowering the Axis Support on the Piers.

A View of the Instrument on the Piers, with Equatorial Dome in the Distance.



The Instrument Completely Mounted.

The Masonry Piers.

THE NEW ASTEROID CAMERA AT THE UNITED STATES NAVAL OBSERVATORY.

Now this camera which is mounted on the big telescope does very good work, but it sadly interferes with the regular work of the big telescope. At the same time, the purchase of a new equatorial mounting, big enough and strong enough to do the work well, is an expensive matter and one which the powers who have charge of the Congressional appropriation would be slow to advise. Matters being in this state, Mr. Dinwiddie, of the Observatory staff, proposed that a double asteroid camera be constructed out of the old equatorial mounting which was put in the junk-pile when the Observatory moved to its present site in 1893. Aided by the far-sighted policy of Admiral Chester, in charge of the Observatory, Mr. Dinwiddie took the modest appropriation which was allowed and set to work.

The first thing to do was to make the plans. The next, to overhaul the discarded mounting and put it together in fit condition to work. This being done, an accurate template was made of the base of the iron mounting, which was used to set the bolts, firmly fixed in cement, at the top of the piers, solidly set on a cement foundation, in the southern part of the Observatory grounds. The piers being constructed, the next thing was to raise the huge iron support for the polar axis in position and bolt it home. This was accomplished with the aid of the scaffolding shown in the illustration, a chain-hoist, worked by man-power, and a little help from other Observatory employés. The scaffolding was limited in size by the length of the timbers which could be conveniently obtained, so that the setting of the iron was somewhat complicated. It was necessary to first raise it as far as possible with a top hoist, and then take hold below the center of gravity, steadying the mass with guys. In this way it was finally placed in position, and shortly afterward the other axis and the central section of the old telescope were placed in position.

A wall of brick and cement was then built around the piers and on this a house erected, Mr. Dinwiddie doing much of the work himself. This house, or shelter, as it is locally termed, is of peculiar construction. It has two rooms, one containing the telescope, the other to be used either for a dark-room or as observers' quarters. The roof over the telescope is mounted on wheels, which run on rails the whole length of the building. When the telescope is to be used, this roof will be slid off its permanent position back over the roof of the second room, thus leaving the telescope free to the heavens. All this can be plainly understood by reference to the accompanying photographs.

When completed, the central section of the telescope tube, which is all that will be carried by the mounting, will have on each side of it a duplicate camera, with separate lens of its own—duplicate, because it sometimes happens that there is a flaw in the plate, causing the observer much lost time and worry. By taking two plates, exactly alike, there will be no possibility of mistaking a flaw for an asteroid, as it is hardly conceivable that the same flaw in the same place should appear in two plates. Through the center of the tube will be a telescope, used for finding and for following.

It may be asked why it is necessary to follow a star if the clockwork turns the telescope and keeps an object oriented in spite of the earth's motion. The reply may be that although the accuracy of the clocks which drive the telescopes is remarkable, they are not absolutely accurate and occasionally vary in rate. So an occasional visual observation is necessary to keep the whole accurately pointed. The telescope is so manipulated that a certain star is exactly on the crosshair in the eyepiece. Should the star get away a little bit, the observer can immediately correct the movement, and as the exposure is so long, such a variation for a short time is ineffectual.

The work has been going on since June, and is rapidly nearing completion. When it is finished, the Observatory will have an asteroid camera which will not only relieve the great equatorial from work for which it was not designed, but an instrument second to none in effectiveness. Incidentally, Admiral Chester will see a tangible, new instrument come into being during his administration; and Mr. Dinwiddie, who planned and carried out the undertaking in the face of such discouragement from many who said the task could not be done, will have cause to triumph, not only in the fact that he has made this apparatus, but that he has put to legitimate use a valuable telescopic mounting which for eleven years has rusted in the scrap-heap.

JAPAN AT THE ST. LOUIS FAIR.

(*Continued from page* 376.)

houses where refreshments are served at all times. There are also a Japanese bazar and several resting places of characteristic architecture. In the gardens surrounding the administration building a successful effort has been made to reproduce the best features of Japanese landscape gardening; so well has this been done that travelers who are familiar with Japan state that they can readily imagine themselves back in the Island Kingdom.

While the outdoor beauties of Japan attract the World's Fair visitor, it is the magnificent handiwork of the Japanese people that makes the most lasting impression. In the Palace of Varied Industries is an exhibit of the most beautiful cloisonné ware ever exported from Japan. This famous ware has never been equaled by any other people. To manufacture the finest quality of it takes nearly a year's time, separate burning and polishing being required for every distinct color used, and these vases and urns are ornamented with pictures in many colors. In nothing else are such brilliant colors to be seen. The decorations consist of flowers, birds, fish, and landscapes in every conceivable shade and color. The process of making this ware is a Japanese secret carefully preserved. Some of these cloisonné vases are valued at several thousand dollars each. They are in all shapes and sizes, from a few inches to eight feet high. There is also a great display of Japanese porcelain ware of many varieties, sizes, and colors, and thousands of bronzes that are highly artistic. The carving is unexcelled, the expression being wonderfully lifelike. Elaborately carved furniture is to be seen in many varieties. The coloring is of the rich and artistic character for which the Japanese are so famous. There are magnificently-carved cabinets of red and black lacquer and gold, and lacquer tea tables inlaid with gold and fine woods.

Passing from the beauties in wood, metal, and porcelain, the visitor approaches a most elaborate and varied display of fine embroidery. Here are kimonos in rich silk, embroidered in most beautiful colors, and various other articles in silk, such as parasols, fans, curtains and wall ornaments. Just beyond are many fine pictures of animals, birds, and landscapes, embroidered in silk. No oil paintings were ever more perfect or more true to life. There is one picture of a cockfight, with feathers flying in the air, so natural in appearance that the scene seems real and the birds actually alive.

There are elaborately embroidered screens which required years to make; magnificent silk shawls, handkerchiefs and other articles for ladies, and thousands of yards of the finest silks; toys in endless variety, fine furs, displays of the best native work in painting and gilding on leather, a great collection of Japanese hats, Japanese lanterns of all sizes, shapes and colors, and a bewildering variety of other art treasures that bear the stamp of Japanese excellence.

A model of a silk factory is a feature of the exhibit, and here, too, the Japanese thoroughness is manifest in every detail. There is a model of the house where the silkworms are reared and cared for. Another building shows where the silk is spun and woven, and the entire process of silk culture is fully displayed.

In the Palace of Education the Japanese exhibit offers another surprise. All the schools of Japan have displays, and more evidences of Japanese thoroughness and attention to detail are given. Charts show the school attendance, averages, the number of readers in libraries, number of copies of journals published, expenditures, etc. The Japanese school course consists of eight years in the primary, five years in the intermediate, three years in the high school and in the university three or four years. They have three kindergartens also and their technical schools, normal schools, and agricultural schools, besides their regular paid institutes, just as they exist in Europe and America. In the public schools the boys are taught bronze work, wood carving, lacquer work, and to paint in water colors, and the girls are taught embroidery. Great care is shown in the methods employed, and nothing is omitted that might aid in perfecting the education of Japanese children.

The busy Japanese are fully alive to their fishery interests, and have an extensive display of fishing boats, tackle, and fishing appliances of every description in their well-equipped section in the Forestry, Fish, and Game Building. Nine distinct varieties of fishing boats are shown.

In the Palace of Agriculture Japan's agricultural display asserts itself. It is in charge of K. N. Ohashi, Japanese commissioner to the World's Fair, and is arranged with great taste as well as completeness. The rice exhibit is the principal feature, and every phase of rice culture is minutely shown. The grain is taken from the time it sprouts, to the matured stalk bearing the ripened rice, twenty varieties of which are exhibited. The insects that injure rice are shown in glass cases, and the diseases affecting rice are shown in their several stages of development. The methods of hunting the insects are illustrated in photographs and drawings. A large display of fruits is exhibited, the Japanese persimmon being present in many varieties. Fruit culture in all stages is seen in pictures and drawings. The culture of tea and methods of growing tea scientifically are shown in detail, even the fertilizers required by certain soils being displayed. There is a tobacco exhibit of considerable magnitude. In Japan tobacco is a government monopoly. The exhibit shows the land desirable for tobacco and the methods of tobacco culture.

At the doorway of the Japanese exhibit of agriculture is a beautiful show-case in the form of a jinrikisha, made of gold and lacquer and valued at $1,000, and a large bush of flowers made entirely of silk.

The important coal-mining interests in Japan are well represented in the Mines Building. We have selected for illustration a complete working model of what is known as Manda Pit, one of six mines owned by the Mitsui Mining Company, of Tokyo, Japan. The shaft has a cross section of 41 feet by 12 feet with a central division for the operation of two separate cages. The head gear above the shaft is 100 feet in height and the head sheave is 17 feet in diameter. The double-cylinder steam capstan engine, represented faithfully to scale in the model, was built by the Müke Engine Works. The steam cylinder is 10 inches diameter by 10 inches stroke, the drum is 6 feet in diameter, and the engine is capable of hoisting a load of 30 tons. There is also a double-cylinder winding engine with cylinders 24 inches in diameter by 5 feet stroke; the winding rope has a circumference of 4½ inches, and the period of one winding is 50 seconds. The model also reproduces to scale the compound condensing steam pumping engine, with steam cylinders 45 inches and 90 inches diameter by 12 feet stroke, and water cylinder 22 inches in diameter. There is also represented a tandem compound screen engine, built at the Müke Engineering Works, Japan, the cylinders being 13 inches and 24 inches diameter by 20 inches stroke. The model also reproduces the screening plant, with revolving tipper 4 feet 10 inches in diameter, capable of tipping three tubs of 1,500 pounds capacity each per minute; a rotating bar screen 5 feet wide by 14 feet long; a gyrating screen 5 feet by 14 feet, a picking traveling band and a belt conveyor. Nearly all of the machinery and general plant represented by the model, and the model itself, were made in Japan, and the whole model affords a comprehensive idea of Japanese advancement in this branch of heavy engineering work.

Limitations of space prevent any detailed references to the exhibit in the Transportation Building, with its large relief maps of the Japanese Empire, on which are marked all the railway, steamship, telegraph, and telephone lines, and the fine display of steamship models, which together speak eloquently of the development of this, the latest of the ancient races to put on the garb of modern civilization.

The Current Supplement.

The current SUPPLEMENT, No. 1508, opens with an interesting article by Dr. Alfred Gradenwitz on some striking repair work done on the steamship "Ekliptika." Excellent illustrations showing the nature of the damage sustained by the craft are published. Emile Guarini describes a very simple portable electric searchlight plant used by the British War Office. "Electrical Transmission Devices for Automobiles" is the title of an article by the Paris correspondent of the SCIENTIFIC AMERICAN, in which he describes the Jeantaud and the "Electrogenia" systems. Perhaps the most valuable article contributed to the current SUPPLEMENT is that by Sir William Ramsay on the "Periodic Arrangement of the Elements." The article is written in a lucid, instructive way that will surely be appreciated at its true worth. Day Allen Willey tells by word and picture how an incandescent mantle is made. Douglas W. Freshfield read before the recent meeting of the British Association for the Advancement of Science a paper on "Mountains and Mankind," the first part of which is published in the current SUPPLEMENT. J. S. V. Bickford thoroughly discusses carbureters.

"American Estates and Gardens."*

This sumptuously illustrated book by Barr Ferree, Esq., treats of the more notable great estates, houses, and gardens in America. It is a volume of 340 pages, with 275 illustrations, of which eight are in duotone and many are full pages.

The illustrations are exclusively from original photographs. They comprise examples of the best work of the most distinguished American architects, and illustrate the most modern tendencies in the design and construction of large houses. The unusual number of illustrations contained in the book, which include exteriors and interiors, together with many garden views, has rendered it possible to illustrate the homes and their surroundings with a degree of completeness not before attempted. The garden views present many of the more recent notable gardens, and constitute a noteworthy feature of the book.

The letterpress has been prepared by Mr. Barr Ferree, and consists of detailed descriptions of the houses and gardens illustrated. The author has an extended personal knowledge of contemporary architecture, and his wide experience as an architectural writer has especially qualified him for this work. A unique value is imparted to the work by the fact that the descriptions are those of a keen observer, fully in sympathy with the beautiful houses he describes.

The book has been prepared for the general reader, and appeals alike to the architect and the house owner, to every one, indeed, who is interested in good building and in the finest types of recent domestic architecture in America.

The work has been beautifully printed on heavy plate paper, the size of the page being 10½ by 13½ inches. It is handsomely bound in green, black, and gold, and in addition to being the standard book on notable houses and gardens in America, it is one of the most attractive gift books of the year.

18,187,918 School Children.

More than 16,000,000 pupils, or 20.04 per cent of the entire population, were enrolled in the common schools of the country in the fiscal year ended June 30, 1904. The total school enrollment for the year, including public and private, elementary, secondary and higher education, was 17,539,478 pupils, and to this there should be an addition made for evening schools, business schools, private kindergartens, Indian schools, State schools for defectives, orphans, etc., 648,440, making a grand total of 18,187,918.

These figures are taken from the annual report of the United States Commissioner of Education. In 1870 the number of pupils enrolled in common schools was 6,871,522, the same being 17.82 per cent of the population. In 1880 the percentage enrolled had increased somewhat, being 19.67 per cent of the population. In 1890 the percentage of the total population was somewhat in excess of the present rate.

The average daily attendance for 1903 was 11,054,502, the same being 69.2 per cent of the total number enrolled. This is the largest average attendance on the number enrolled ever reported in the United States. It was only 59.3 per cent in 1870.

Women are rapidly supplanting men as school teachers. Male teachers formed nearly 39 per cent of the entire number in 1870, and nearly 43 per cent in 1880, but only 34 per cent in 1890, and only 26 per cent in 1903.

The average monthly wages of teachers for 1903 was $49.98 for males and $40.51 for females, a slight increase over the previous year.

According to an estimate of the report the total amount of schooling given to the average of population has risen from 82 days in 1800 to 1,034 days in 1903.

Experiments have been carried out by the British naval authorities with a new method for combating submarine vessels. This device comprises a new type of quick-firing torpedo. This missile is less than 6 inches in diameter and carries, of course, a smaller explosive charge than the 18-inch weapon, while furthermore it is not provided with a gyroscope. The new torpedo is fired from an above-water tube, and the mechanism is so arranged that the weapon sinks when it has reached its limit of range, if the object at which it was discharged is missed. The trials are being carried out at Portsmouth and are being followed with great interest, as it is considered a more effective means of fighting the submarine than the system of entangling them in wire nets.

* Quarto, 340 pages, 275 illustrations. Munn & Co. Price $10.

NEW ANTELOPES AT THE N. Y. ZOOLOGICAL PARK.

BY J. CARTER BEARD.

It is by no means an easy matter to assign their proper place in the animal kingdom or to determine what really constitutes an antelope. In looking for the origin and the derivation of the word itself, we are led back through the Latin and the Greek to the old Coptic word *pantholops*, from which was derived *antholops* (*Ἀνθόλοψ*) the name in later Greek for the fabled unicorn. As this mythical animal has been determined to be nothing more than a distorted idea of a gazelle, it ought perhaps to follow that the particular sub-family, *Gazellinæ*, to which the twenty-three known species of gazelles belong, should be that to which alone the term antelope should be applied, if it is employed in any restrictive or definable way. The name, however, has been extended to embrace all ruminants in which the horns are hollow at the base, set upon solid cones, and are permanently retained throughout the life of the animal, as well as some others in which this does not occur. No better opportunity has ever been given in this country to see for one's self the different members of this family, from the pygmy Duykerbok antelope to the ox-like eland, and from our own aberrant type, the American prong-horn antelope, to the still more aberrant giraffe, than is now given by the incomparable collection of antelopes at the New York Zoological Park.

The completion of the antelope house marks the fruition in part of purposes and ambitions entertained many years ago by the present very competent director and manager, Mr. W. T. Hornaday.

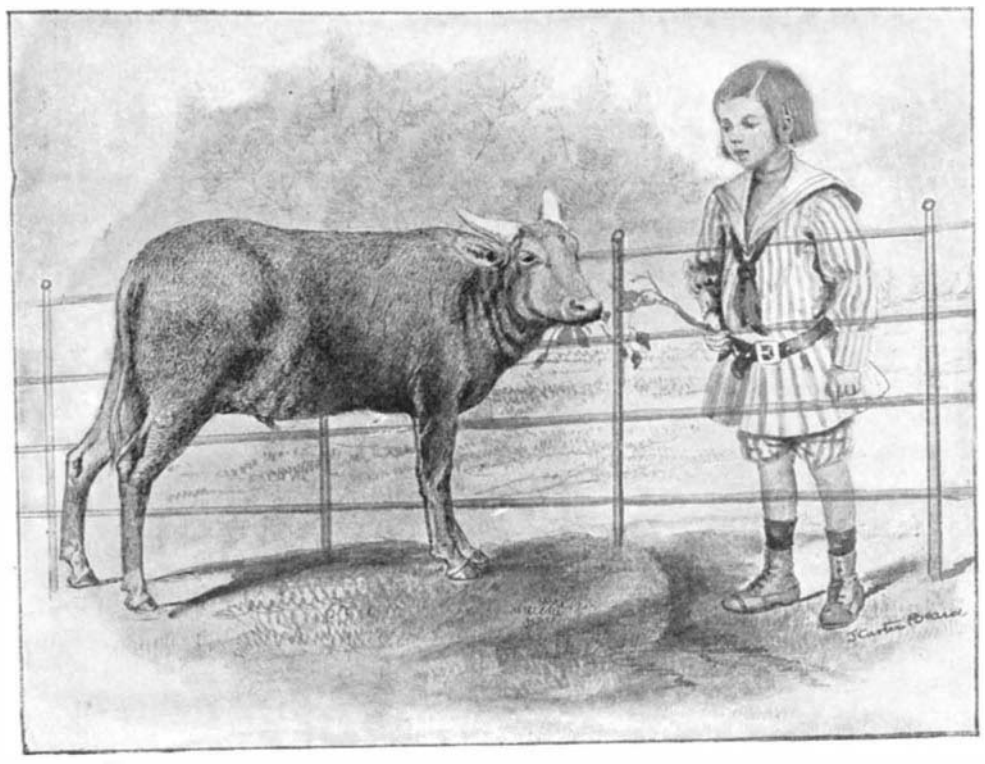
"Ever since the opening day of the park," writes Mr. Elwin R. Sanborn, "the temptation to secure some of the interesting antelopes now becoming so rare has been difficult to resist. But the futility of this desire, until suitable quarters could be provided, was so strikingly exemplified by the perplexing task encountered in the care of a few tropical deer through the winter, that no other argument for its abandonment was necessary.

"The new antelope house was in consequence built, and 'opened to the public,' with every stall occupied, the Society subscribing the entire list of specimens, amounting in round numbers to fifteen thousand dollars." The list of antelopes on exhibition is a long one. The SCIENTIFIC AMERICAN has already published descriptions of several of the rarer sort, together with pictures of the animals; but there remain many others quite as worthy of notice. Among the most singular types in some respects are the water antelopes. There are five allied species, of which the Sing-sing antelope, a fine specimen of which is to be seen at the park, is a representative.

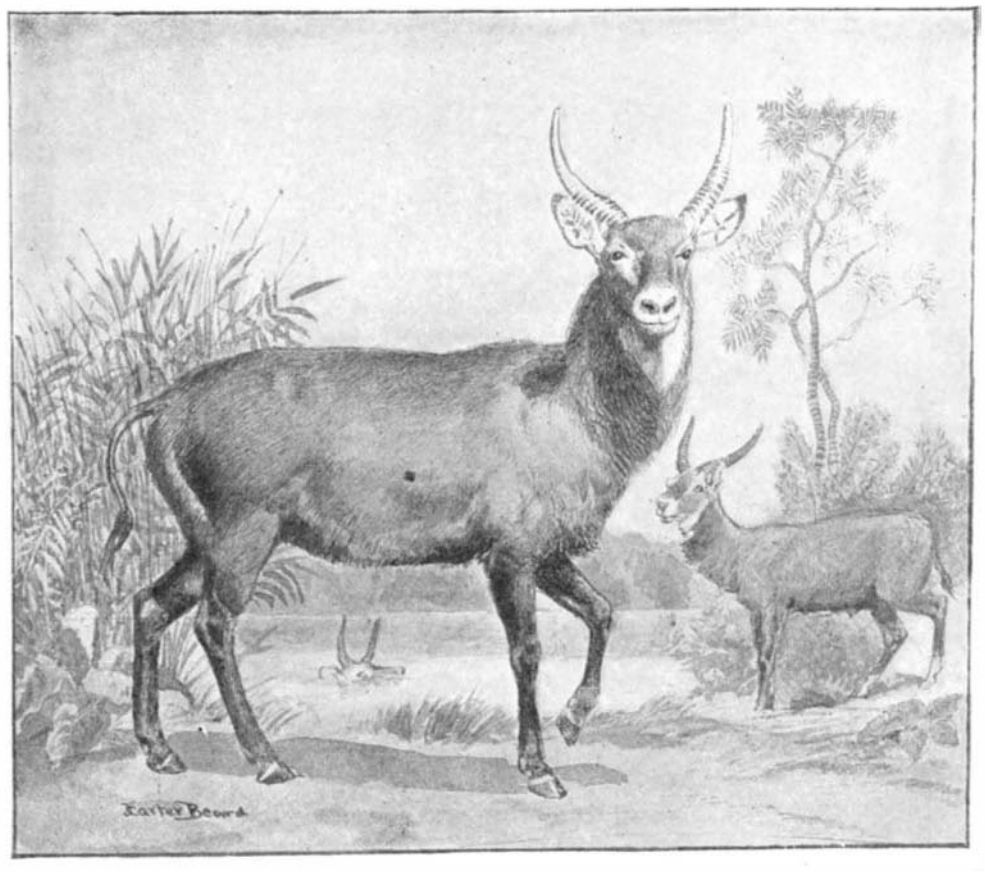
It scarcely carries out our idea of an antelope, being a rather heavily-built animal, which, instead of presenting the sleek, glossy, appearance of other members of its family, is clothed with a coat of long, soft, loose, and flocculent hair, longer upon the neck than elsewhere, but not forming a mane. The color is grayish brown. The males alone carry horns. These in the adult individual are lyre-shaped, and covered almost to the tips with bony rings. The animal exhales an odor, and the flesh is so powerfully scented and of so bad a flavor as to be entirely uneatable, a circumstance which will go far to preserve the species from becoming exterminated, long after its congeners have disappeared forever from the face of the earth. The natives, we are told, tame these antelopes, and allow them to run with their cattle (in much the same way as we keep a goat in the stable) because the animal is supposed to bring good luck and ward off disease.

Sing-sing antelopes abound in marshy districts on the banks of lakes and rivers in central and western Africa. If disturbed, they invariably make for the water at full speed. In this way they escape lions and leopards, who in common with other cats are reluctant to take to the water, but they cannot get away from the natives, who pursue them in boats, which they paddle faster than these antelopes can swim.

An animal rare even in the range of country it inhabits is Baker's roan antelope (*Hippotragus equinus*). The first of its species ever brought to America is a remarkable-looking creature. Its large, singularly shaped ears, stiff, upright mane, and peculiarly-marked face distinguish it from any of its congeners. It is a big animal, too, standing over four feet and a half high at the shoulders. The horns of the male have been known to grow to a length of three feet and a half, measured along the curve. It is a rare animal even on its range, which extends from central south Africa to Senegal. It is quite possible, considering the rapidly-approaching extinction of African antelopes, that this is the only member of its species that will ever be seen in this country.



Little Anoa Bull or Antelope Buffalo at the New York Zoological Park.



The Sing-Sing or Water Antelope.

ANTELOPES AT THE NEW YORK ZOOLOGICAL GARDENS.

In view of the fact that the curious little anoa has been adopted, along with the other inhabitants of the Philippine Islands, as a citizen of the "Greater United States," the specimens at the New York Zoological Park assume an additional interest.

Although the anoa is ranked among ungulates with the oxen, and more particularly with the buffaloes, it has so many features in common with the antelope that it is sometimes called the antelope buffalo. It is a veritable pygmy, being when full grown, according to Mr. Hornaday, two feet nine inches high at the shoulders. "We have," says the last-mentioned gentleman in writing to me, "three specimens at the park, two full-grown males and a female, the latter immature. These little creatures take kindly to captivity in zoological gardens, and breed with fair regularity. Two of those that we have are quite docile, but the third, a full-grown male, was once so savage that for nearly a year he was bent on killing something or somebody. The creature is quite cow-like in form, but its horns most nearly resemble the horns of the harnessed antelope of Africa, except that they are not twisted. The color is a rich, chocolate brown, becoming dark with age. Celebes is the home of the specimens which we have."

The species which inhabits the Philippines (*Bos mindorensis*) is called tamarao. "It stands," writes Richard Lydekker, "three and a half feet in height. The horns, though massive, are comparatively short and rise upward in the plane of the face with a lyrate curvature; they are distinctly triangular, with the largest face in front, and are somewhat roughened. In its massive form, thick legs, and uniform coloration this species comes nearer to the Indian buffalo than to the anoa."

It may be added that, as far at least as the anoa of Celebes is concerned, the animal seems to occupy a place almost exactly half way between the antelopes and the oxen. "It approximates to the antelopes," writes Lydekker, "in its slender build, the structure of the hinder parts of its skull, the upright direction and the straightness of its horns, the spots on its head, back, and limbs, and its small size."

Lloyd's, and What It Means.

Lloyd's dates from the latter part of the reign of Queen Elizabeth, and had its origin in a small coffee house in Tower Street, kept by Edward Lloyd. He was an enterprising man, and through his business contact with seafaring men and merchants enlisted in foreign trade, foresaw the importance of improving shipping and the method of marine insurance. He was the founder of the system of maritime and commercial intelligence which has been developed into its present effectiveness. Before the time of Edward Lloyd maritime insurance in England was conducted by the Lombards, some Italians, who founded Lombard Street, but after Lloyd embarked in the business Britons conducted marine insurance in London.

The subjects of marine insurance are the ship, the cargo, and the freight, all of which may belong to different parties. In time of war there is what is termed the maritime risk—the danger from accident, collision, and stranding—which is distinctly separate from the risk of capture and seizure by an enemy. This class of marine insurance had its inception in the conditions arising during the seven-year French-English war of 1757 to 1763.

Lloyd's moved to Pope's Head Alley in 1770, and in 1774 removed to the present quarters in the Royal Exchange. In 1871 Lloyd's was incorporated by act of Parliament. This act defined the objects of the society to be: (1) The carrying on of the business of marine insurance by members of the society; (2) the protection of the interests of members of the society in respect of shipping, cargoes, and freights; (3) the collection, publication, and diffusion of intelligence and information with respect to shipping.

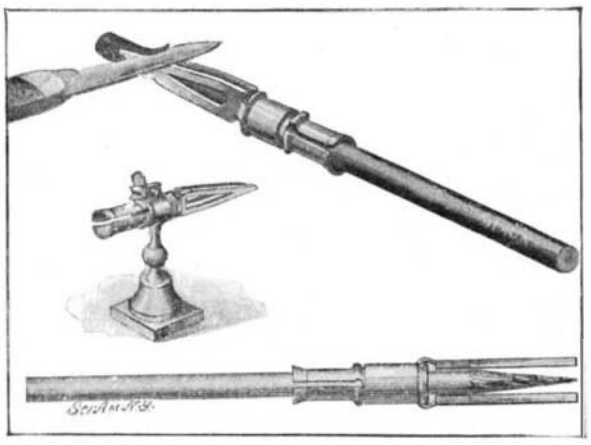
The corporation of Lloyd's and the committee of Lloyd's, who are the executive body of the corporation, and the secretary of Lloyd's, have practically nothing to do with marine insurance in the way of taking risks or paying losses. Their duty in this respect is to afford marine insurance brokers who wish to effect insurances a place of meeting with those who undertake the risks.

A new substitute for nickel, called "Patrick metal," is being placed upon the English market. The feature of this metal is that it is silver-white right through, and retains its bright appearance permanently. The luster does not tarnish with use—in fact, it becomes brighter. It retains a high degree of polish, and will not rust even under the most unfavorable conditions, nor oxidize easily. It is malleable when cold and can be easily soldered or brazed.

Patent Department

DEVICE FOR USE IN SHARPENING PENCILS.

A rather novel invention is pictured in the accompanying engraving. It consists of a device adapted to assist in sharpening pencils accurately and quickly. It is usually held that the correct way to sharpen a pencil is to hold the point against the right thumb,

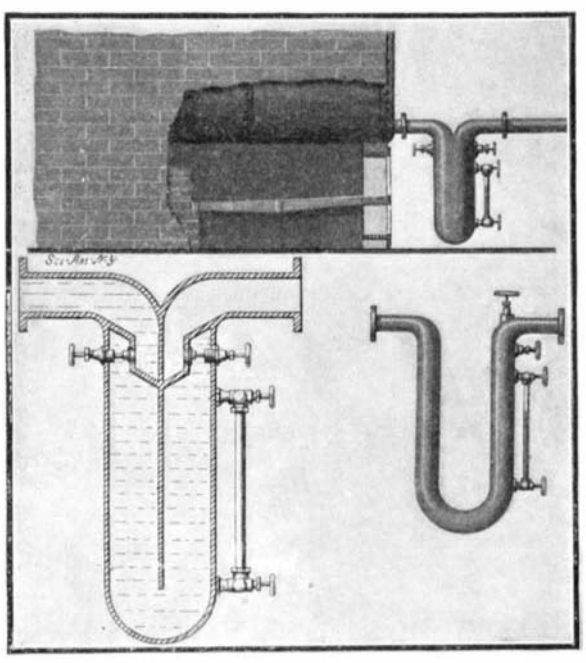


DEVICE FOR USE IN SHARPENING PENCILS.

and cut away the surplus wood and lead by drawing the blade of the knife toward the thumb. This method is open to the objection that it is apt to soil the thumb and fingers. On the other hand, the more cleanly method of sharpening a pencil by cutting outward, that is, away from the body, is apt to result in too deep a cut and the consequent breaking of the pencil point. The device here illustrated is adapted to provide against these objectionable features, permitting accurate sharpening of the pencil without in the least soiling one's hands. We show two forms of the device, one of which may be carried in the pocket, and the other mounted on a stand. In each case the device consists of a sleeve mounted to turn freely on a tubular member, which snugly fits the pencil. The sleeve is formed with projecting guide fingers tapered to the proper angle. In use the knife blade bears against the edges of the guide fingers, and is thus prevented from making too deep a cut in the pencil. The pencil is turned in the sleeve as a bearing after each cut so as to bring a new surface under the knife. The inventor of this device, Mr. A. D. Fagrelius, lives at 3106 Lucas Avenue, St. Louis, Mo.

BLOW-OFF MECHANISM.

A patent has recently been granted to Mr. James M. Fagan, of 135th Street and Willow Avenue, New York city, on improvements in blow-off mechanism or valves for steam boilers. The invention provides a blow-off of simple and novel construction, so arranged that a main valve when closed will be submerged in clear water, thus reducing to a minimum the danger of de-



BLOW-OFF MECHANISM.

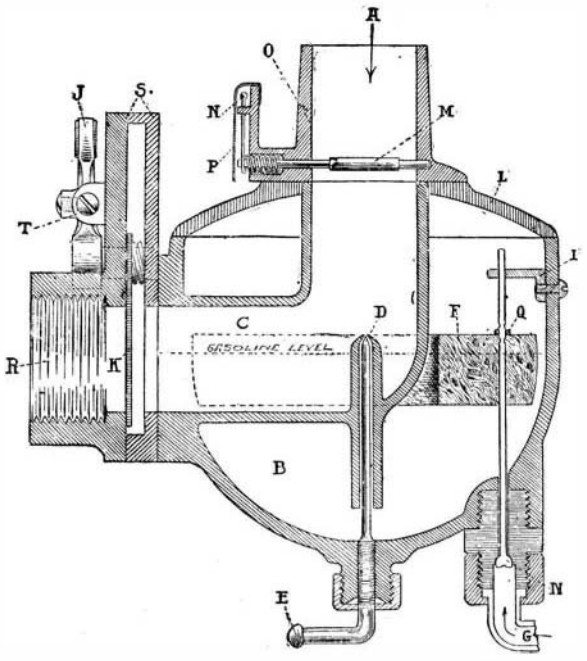
stroying the valve by the action of scale or sediment. Also the position of the valve is such that scale will not adhere to it when the device is in operation. As indicated in the accompanying engraving, and as shown most clearly in the lower left-hand view, the invention comprises a casing divided centrally by a partition, which extends from the top to within a short distance of the bottom of the casing. The casing is thus formed with two water-legs, that at the left being termed the "inlet" leg, and the other the "outlet" leg. The latter is connected with an outlet pipe, and the former communicates with the boiler. Extended across the upper portion of each leg is a diaphragm having a vertical wall provided with a valve seat. The valve which is seated in the diaphragm of the outlet leg is the main valve, and the valve in the other leg is an auxiliary valve. In operation the main valve is opened wide, and the inflow is regulated by the auxiliary valve. In shutting off the flow the auxiliary valve is closed, and though some of the dirt and scale may be caught between the valve and its seat, it will not, however, cause sufficient leaking to prevent the operation of the device, or never enough to prevent the suspended matter in the water from settling to the bottom of the casing, leaving the main valve in clear water. The main valve can then be tightly closed, as the valve seat will be clean. The clearing of the water may be observed in a glass sight tube, communicating at the top and bottom with the outlet leg. We also illustrate a modification of the device, in which the water-legs are formed of a length of pipe bent to a substantially U shape. The auxiliary valve may be seated in a diaphragm extending across the upper end of the outlet leg above the main valve.

New Car Replacer.

The Philadelphia Rapid Transit Company is at present conducting some experiments with a car replacer invented by Thomas Crawford, a resident of that city. The device has the advantages of being quite small and comparatively light, so that it can be placed on every car, or where the running time of cars is close, as in the cities, it can be at least placed on cars at more or less close intervals. For the purpose of placing a derailed car again on the tracks, a pair of implements is used much alike in design and general appearance. Each of these consists of two parts, the guide rail and the bridge. The former is a long tapering tongue with a groove extending along its length. The larger end of the guide rail fits loosely but securely in the other or bridge portion, which consists mainly of an inclined surface with its lower edge ending at the flange of the rail when the device is in place. The other of the pair has, in addition to the parts described above, also a lip by which it is held firmly in place when in use. The function of the guide rail is to direct the car wheel up onto the bridge, whereupon the wheel slides down the incline and falls into its proper place on the rail. Where the car has been carried some distance from the track, it is possible to work it back gradually by successive attempts, using the replacer until the wheel gets sufficiently close to the track to get the tongue under it and the other end of the replacer on the tracks. This device was given a number of severe tests by some of the officials of the company, and its operation was perfect in every case. The pair of implements which constitute one replacing set weighs but a trifle over fifty pounds. Their cost is but little.

THE SCHEBLER AUTOMATIC CARBURETER.

An exceedingly compact and simple carbureter for gasoline engines is shown in cross section in the accompanying diagram. As can be readily seen, the carbureter consists of a float feed chamber, *B*, through which passes the air pipe, *A C*. The spraying nozzle, *D*, projects from the chamber, *B*, into this air pipe, and the U-shaped cork float, *F*, fits around it. The gasoline enters through the pipe, *G*, and the ball valve, *N*, which is on the end of a spindle that passes through and is secured to the float at *Q*, besides sliding up and down in the bracket, *I*. The valve is set to close when the gasoline has reached the level indicated. *K* is a throttle valve which can be swung up into chamber, *S*, by means of lever, *J*, which is pivoted at *T*. The carbureter is screwed on the inlet pipe of the motor at *R*. *M* is a flap valve which is held in a horizontal position by a spring which can be adjusted at *N*. The valve, *M*, does not close the pipe entirely; but when the motor speeds up, and the suction becomes more intense, it opens proportionally, thus making a greater inlet for the air, and so keeping the suction at *D* practically always the same. The result is that the quantity of gasoline which is drawn from this nozzle is the same at all speeds of the motor (provided, of course, that the throttle is wide open) and so a constant and perfect mixture is always obtained after the needle valve, *E*, and the spring, *N*, have been once properly set. The latest model of this carbureter has an elbow on top through which the air enters, instead of through *A*. Fitted in this elbow is a sort of piston valve with an adjustable spring which gives a wider range of adjustment than the arrangement shown. A test of this carbureter which we made recently on a single-cylinder gasoline car showed increased and almost constant torque at wide ranges of speed of the motor, which it was possible to throttle down so that it was just turning. The exhaust flame was of a light blue color, showing perfect combustion. An increase in power and speed was also noticeable. The carbureter is a fair sample of the type termed "automatic," which is now used in place of the hand-regulated kind on all first-class automobiles. It is one of the most compact pieces of gas engine apparatus which we have seen, as the

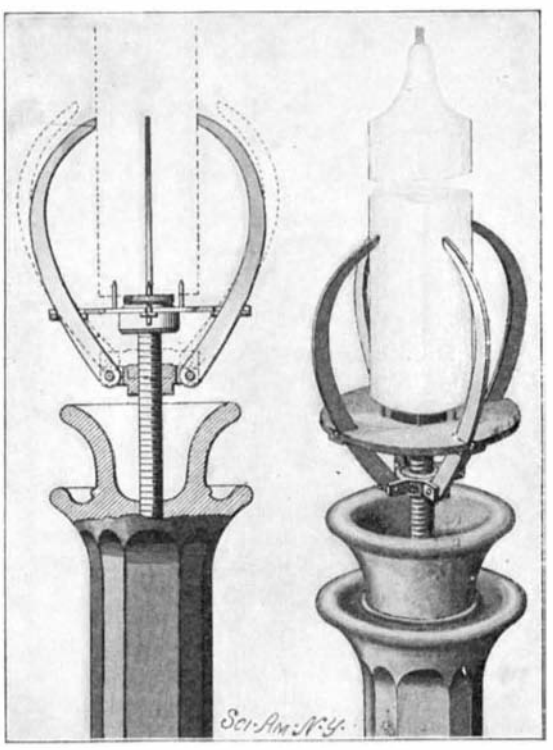


SCHEBLER AUTOMATIC CARBURETER FOR GASOLINE ENGINES.

float chamber and air pipe are combined in one, as shown. The general sales agent for the United States is Mr. F. H. Wheeler, Box 276, Indianapolis, Ind.

AN ADJUSTABLE CANDLE HOLDER.

The difficulty with most candle holders is that they are not made adjustable to the many different sizes of candles which they may be required to hold. In the accompanying illustration we show an improved candle holder, in which the necessary adjustment can be very quickly and easily made. The holder comprises a headplate mounted to turn freely on the upper reduced portion of a spindle centrally secured in the main standard of the candle holder. The plate is retained in position on the spindle by a knurled nut. A pivot pin projects from the center of this nut, and several pins project from the plate adjacent to the nut. The main body of the spindle is threaded to receive an adjusting nut, to which are pivoted several curved retaining arms. The arms pass up through slots in the edge of the head-plate, in which they are movably held and guided by means of narrow metal strips secured across the ends of the openings. In use the retaining arms are first spread out by rotating the head-plate and adjusting nut about the spindle in the proper direction to feed the adjusting nut upward. The candle is then forced down onto the pins projecting from the retaining nut and the head-plate. Then, on rotating the plate



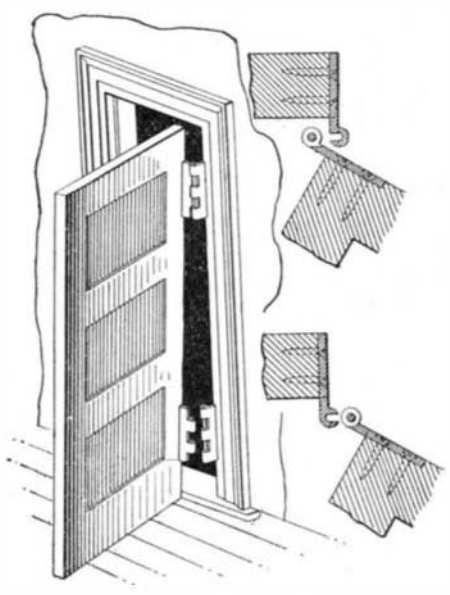
AN ADJUSTABLE CANDLE HOLDER.

in the reverse direction, the nut will be fed downward, causing the sharpened ends of the retaining arms to close against the candle and firmly grip it. The parts may be securely retained in any desired position by tightening a set-screw, which is threaded into the adjusting nut and bears against the spindle.

Mr. P. J. McGuire, of 389 East Santa Clara Street, San Jose, Cal., is the inventor of this improved candle holder.

ODDITIES IN INVENTION.

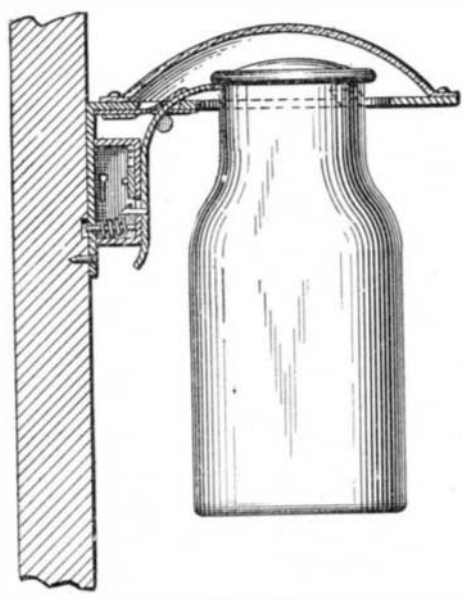
SEPARABLE HINGE.—Great difficulty is often experienced in hanging a door or shutter provided with ordinary hinges, and an inexperienced person sometimes finds it almost impossible to replace a door which has been unhinged. A New Yorker has invented an improved type of hinge adapted to overcome this difficulty. The construction also provides easy access to the pintle for the application of a lubricant thereto.



SEPARABLE HINGE.

As revealed in the accompanying illustration the pintles are formed integral with the leaves which are attached to the door jamb, while the other leaves of the hinges are formed with slotted knuckles adapted to fit into recesses in the pintle hinges and engage the pintles. The slots in the knuckles of the door-leaves, however, are oppositely disposed, so that when mounting the door the upper leaf is first moved into engagement with its corresponding pintle leaf and then the lower one is moved into position. The door is kept thus in hinged position by the action of gravity but can be unhinged by a horizontal pull. By examining the illustration it will be observed that upper leaves cannot be disconnected until the door is wide open.

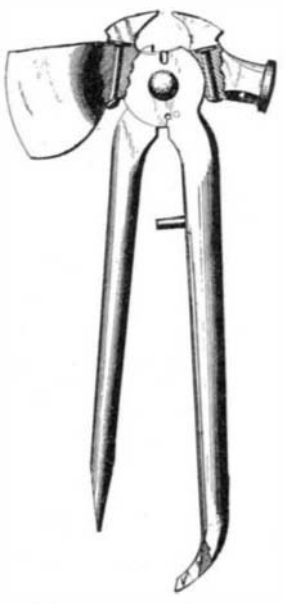
LOCK AND PROTECTOR FOR MILK JARS.—Milkmen in some localities have a great deal of difficulty in safely delivering milk to their customers. Owing to the fact that they make their rounds long before their customers are up in the morning, they have to leave the jars of milk outside the door or at some hiding-place designated by the customer. The milk is thus liable to be stolen if the hiding place is discovered by an unauthorized person. To remedy this evil the jar-lock illustrated herewith has been invented. It consists of a plate formed with a central opening to admit the neck of the jar and is secured to the door frame or the side of the building by means of a bracket. Projecting into the aperture of the plate are a pair of lugs, preferably located near the outer end of the plate,



MILK-JAR LOCK.

while at the inner end is a lever, the tip of which projects into the aperture when the device is in locked position. The lower end of this lever carries a catch adapted to be engaged by a tumbler in the lock which is mounted on the main bracket of the device. Normally the lever is held in open position by a spring-pressed pin projecting through the casing of the lock. In use the milk jar is slipped into the aperture of the plate, with the rim resting against the lugs. The lever is then pressed back to the position illustrated, in which it will be held by the spring tumbler. The tip of the lever is thus pressed against the inner side of the rim, holding the jar firmly in place. The jar cannot then be removed without raising the tumbler with a key.

COMBINATION TOOL.—A combination tool which possesses considerable merit has recently been patented by an inventor in Kansas City. The tool is capable of performing the functions of a hammer, a hatchet, a nail-puller, a wire-cutter, a staple-puller, a screwdriver, and a wire-tightener. It consists essentially of a pair of pivoted levers. The longer arm of one of the levers is curved and bifurcated at the end to form a nail-puller, while the shorter arm of the same lever carries a hatchet blade. The longer arm of the other lever is sharpened at the end to form a screwdriver, while the shorter arm of the same lever carries a hammer head. Just above the pivot pin of the tool the two levers are notched, and the shearing action at these notches enables the operator to nick or cut small pieces out of metal or wire. Wire may also be cut by threading it through holes formed in the two levers immediately below the pivot and then shearing it by pressure on the levers. Two claws are riveted to the levers, one adjacent to the hammer head and the other adjacent to the hatchet blade. These will be found convenient in pulling staples. The claws are so shaped that they also afford a convenient means for taking up the slack in a wire.



COMBINATION TOOL.

TELEPHONE DIRECTORY.—A telephone directory of novel form is shown in the accompanying engraving. It is made up of a flat disk with a central orifice which embraces the mouthpiece of the telephone. Radially disposed on this plate are a number of name-strips which are held in place by means of retainers. These consist of a pair of wire rings woven in and out through the disk, thus forming loops through which the name-strips are inserted. The disk may be revolved to bring any desired name strip into more convenient position. A pointer is provided, as shown, which may be moved to indicate the card of a subscriber whom the user desires to call or with whom he has been unable to make connection. It will be observed that the name strips can readily be removed and replaced by new ones whenever occasion may require.

A NOVEL TELEPHONE DIRECTORY.

Brief Notes Concerning Inventions.

An ingenious device for brushing clothes, in lieu of the more conventional clothes brush, has been introduced into a London hotel. It is an adaptation of the vacuum cleaner, now extensively utilized for cleaning carpets, furniture, etc. By this apparatus every particle of dust and dirt in a person's clothing can be removed much more quickly and thoroughly than with a clothes brush, which only removes the surface dust on the apparel. In the basement of the hotel is installed a small air pump driven by an electric motor. From this a long tube extends to the suction nozzle of the apparatus, placed in the vestibule of the hotel. An attendant passes this nozzle quickly over the clothes of the customer, and all the dust is drawn from the cloth into the machine.

For the purpose of preventing dishonest employes from robbing the store of their employer, by reason of the fact that they have been intrusted with the key of the plant, a new invention in the way of locks has been recently patented by F. M. Thompson, of Danbury, Vt., the novelty of which is that it is operated by three keys. The person whose duty it may be to lock the establishment up each evening has one key, and while this will permit of the closing and securing of the door, it will not open it again. The boy to whom is intrusted the duty of opening in the morning has another key, which will answer his purpose only, that of unlocking. The third key referred to is the master key, in the hands of the proprietor, by which the lock may be operated at any time.

Tableware which closely resembles fine translucent china, and which is said to be almost impossible to break, is the produce of a Liege, Belgium, establishment, and so remarkable is this article that it has been made the subject of a report by the United States consul at that point. Severe and unusual shocks and sudden changes of temperature have little or no effect on these dishes, and the consul making the report says that he saw pieces of the ware used to drive nails with, and also thrown around on a stone floor, without the slightest damage being sustained. The resisting power of this ware is due to the special hardening process and to the nature of the crystal used in its manufacture. The color of the hardened crystal ware is of a blue white, and not the pure white of porcelain. The same firm also makes glassware of a corresponding hardness.

Joseph G. Branch, the Chief Inspector of Boilers and Elevators of the city of St. Louis, Mo., is the inventor of a life net which is designed to be placed in the bottom of an elevator shaft, for the purpose of catching persons who may be unfortunate enough to fall by any chance through any of the openings of the well. It consists of a wire net, held on two sides by rods, which are in turn supported by strut arms. The lower ends of these arms fit the bearings of pillow blocks, which are bolted to a stout plank secured on the bottom of the shaft. The net is held taut by large compression springs acting at the upper end of the strut arms. When a falling body strikes the net, the fall is broken by the combined action of the net and springs, the arms closing up scissors-like, and after taking the force of the fall, the net resumes its former position through the action of the springs. The device is inexpensive and durable.

Reference has been made heretofore of the aerial merry-go-round which has lately been erected in one of the London amusement gardens, which is said to have been designed by Sir Hiram Maxim. Because of the fame of its inventor and of the gigantic proportions of the device, this apparatus attracted a great deal of attention, but it subsequently developed that very similar devices had been made for several years by a Philadelphia firm and shipped to various points about the country, principally in the West. The English papers have now discovered that the same idea had been in vogue as early as 1882 in their country, the invention of J. G. Inshaw, but being very much smaller had probably made no lasting impression. The principle made use of in the two devices is the same, but in Mr. Inshaw's device there were accommodations for thirty-six persons only. As previously noted, the Maxim construction is much larger.

The Los Angeles Railway Company makes use of an exceedingly novel arrangement for operating a group of switches in that city at the intersection of First and Spring Streets. At this point there are double tracks crossing each other and two double-track connecting curves. The cars of three lines pass here, and under ordinary circumstances the street-car traffic amounts to 210 cars per hour. On holidays and special occasions this number is somewhat increased, so that the switching of the cars manually, as it was done until recently by one man, became quite a gymnastic feat; and although the man became very expert, there were frequent delays at this point. A system of operating the switches from one point has been recently put into use, and there is a great improvement shown in the handling of the cars. The system is the patented invention of Dr. W. J. Bell, a dentist of that city. The operator is placed in a tower on a pedestal over the sidewalk, where his house is entirely out of the way and where he can have an unobstructed view of the cars and tracks. Liquid pressure is made use of as the medium of moving the switches, oil being used as the fluid. The pumps and other mechanism are located in the tower house, and are driven from the 500-volt railway current. To each of the four switches is run a pressure pipe three-quarters of an inch in diameter. All the switches are held in the usual position, that is for straight track, by means of springs. When the operator desires to throw a switch, he pulls down the valve handle to a horizontal position, which movement opens a three-way valve, and allows oil under a 60-pound pressure to move the switch tongue over against the force of the springs. A thin paraffine oil from which the solids and distillates have been removed is made use of. This is practically non-inflammable, and has the additional advantage that it will not freeze in the colder climates where the system may be made use of.

RECENTLY PATENTED INVENTIONS.

Electrical Devices.

TROLLEY.—J. W. ROCKAFELLOW, Sergeantsville, N. J. This invention relates to improvements in trolleys for electric-railway cars receiving current from suspended wires or conductors, the object being to provide a trolley with a simple device to prevent the trolley from jumping off the conductor, the said device being adjustable to adapt the same to conductors of different shapes or sizes.

ATTACHMENT FOR PARTY-LINE TELEPHONE SYSTEMS.—W. A. SHACKELFORD, Lexington, Ga. The advantages in this case, are: First. Any subscriber other than those engaged in conversation, is prevented from hearing it between those using the line. Second. Several pairs of stations upon the same line may be in communication at the same time without interference with each other, the line being thus practically divided up into several circuits. Third. When two subscribers are talking, the lines are grounded (or metallic circuits completed according to system used) upon either side of the two stations in active use, thus lessening resistance of circuits and improving the service.

PARTY-LINE TELEPHONE SYSTEM.—F. VOLLMER, Winsted, Minn. Mr. Vollmer's invention relates to telephony, his more particular object being to produce a system in which a subscriber at one station may call a subscriber at any station selected without disturbing other stations upon the line and yet silently indicating to all other stations that the line is busy.

Of Interest to Farmers.

PLOW.—E. B. WINTERS, Coffeyville, Kan. One purpose of the invention is to provide two levers for accomplishing adjustments—that is, one lever for adjusting a single wheel on one side and a second for adjusting the wheels on both sides—which levers are arranged in close proximity to each other and on one side of and adjacent to plow-beam. These levers are preferably placed to right of plow-beam, with driver's seat on left of beam, thereby making it perfectly convenient for driver to manipulate said levers with right hand, while guiding the team with lines in his left hand. It is an improvement on a plow formerly patented by Mr. Winters.

GATE.—J. GRANGER, Springer, New Mex. The purpose of this invention is to provide latch devices for the gate operated through the medium of the cables, which latch devices are automatically released from their keepers when the gate is opened and automatically engage with the keepers when the gate is closed, the latches being directly operated by link connection with the mechanism acting directly on the gate and operated by the cables. It relates to a former improvement for which Mr. Granger was granted Letters Patent.

Of General Interest.

HEATER FOR PRINTING-PLATES.—G. H. KENDALL, New York, N. Y. In Mr. Kendall's patent the invention has reference more particularly to improvements in means for heating the engraved steel plates in printing-presses, the purpose being to provide a heater carried by the press bed-plate whereby the printing-plate is kept heated at a practically uniform temperature.

NON-REFILLABLE BOTTLE. — G. S. GOLDIE, Manitowoc, Wis. This invention refers to improvements in bottles of the non-refillable class, the object being to provide a bottle of this character that will be simple in construction, comparatively cheap to make, and by the use of which both the original bottle and the purchaser will be protected from fraudulent reuse of the bottle.

METHOD OF TREATING SHEET IRON OR STEEL.—H. H. GOODSELL, Leechburg, Pa. This invention has reference to a process for treating sheet iron or steel, and more particularly for causing a uniform and thorough oxidation upon the exterior of the sheet, so that the oxid will adhere firmly to the sheet, being practically a part thereof, and presenting an elegant appearance, besides being very durable.

PAPER BOX FOR PACKING BOTTLES.—J. T. CRAW, Jersey City, N. J. This knockdown box is adapted for packing bottles, especially such bottles as are used for marketing small quantities of ink, mucilage, etc., which box may be constructed to receive bottles having top and bottom body-flanges, the bottles having straight or smooth bodies, the box so constructed that bottles may be conveniently and quickly placed or removed and held safely packed and separated for transportation or storage without sawdust or like packing material.

TWINE HOLDER AND LIFTER.—E. S. ALDERMAN, Marietta, Ohio. In this patent the invention is an improvement in that class of twine-holders which are provided with a take-up for the twine in the form of a roller-weight, the frame of the device being adapted to be suspended from the ceiling or other support. The construction and arrangement and combination of parts are such that friction is reduced to a minimum. The entire apparatus suspends by a hanger.

OPTICAL TOY.—W. H. ZIMMERMAN, Hallethorpe, Md. The invention is designed to provide a simple toy of a general character which may be made and sold for a very small price and which is so constructed as to be made and sold in what is known as the "knockdown" form, in which for convenience of storage and cheapness of transportation the parts are dismembered and packed into small compass and as quickly and conveniently erected for use. This optical toy is designed to furnish both amusement and instruction.

KILN.—W. N. WEIR, South River, N. J. The object of this improvement is to provide a kiln more especially designed for burning bricks and other clayware and arranged to utilize the fuel to the fullest advantage, and thereby render the kiln exceedingly economical, at the same time permitting a continuous operation.

BASKET-HANDLE.—R. C. TOTZKE, St. Joseph, Mich. In this patent the object of the invention is to provide a basket-handle of wire or similar material which may be used instead of the ordinary wooden handles provided upon veneer baskets and which is adapted for application to baskets of different sizes and with reinforcing strips of different widths disposed along the upper margins thereof.

BASS DRUM AND CYMBAL ATTACHMENT.—J. P. STANTON, San Francisco, Cal. In the present instance the object of the invention is the provision of a new and improved bass drum and cymbal attachment whereby the bass drum and cymbal can be beaten separately or simultaneously by a pedal action controlled by the foot of the musician.

SAFETY COMMERCIAL PAPER.—J. ROWAN, Ottawa, Canada. Mr. Rowan's invention relates to commercial paper, such as is used by bankers, merchants and other business men, his object being more particularly to so prepare a paper that alterations in the condition of the paper—such, for instance, as the erasure of intelligible characters or the addition of said characters thereupon—may be readily detected. Another object is to provide a paper and ink therefor such as will not deteriorate with age and in which the fabric of the paper is not injuriously affected by ink used thereupon.

SAFETY-CATCH FOR PINS.—A. M. REMINGTON, Fitchburg, Mass. The catch is for use in connection with pin-fastenings for articles of jewelry, such as brooches, breastpins, and the like. The object is to provide a device of the character specified which will hold the pin with absolute security, so as to prevent all possibility of accidental detachment of the pin from the garment or other support upon which it is fastened.

HYGIENIC NIGHT-STAND.—N. FAUCON, 8 Place Darcy, Dijon, Côte d'Or, France. This new night-table is essentially characterized by the fact that it comprises two levels of same height entirely open upon their four faces and four panels vertically movable in order to constitute the box intended to contain the pot, sometimes at the upper level, sometimes at the lower one. Under such conditions the airing of the table is perfect and no nauseous odor can be accumulated therein.

BOX.—J. DOROS, New York, N. Y. In this case the improvement refers to boxes or chests used for shipping fabric piece goods and other merchandise; and its object is to provide a box which is exceedingly strong and durable, comparatively cheap to manufacture and free of projecting nails or like fastening devices to prevent injury to the merchandise in packing or unpacking the same.

COUPLING FOR GAS-HOSE.—H. ACKERMAN, Newark, N. J. The main purpose of the invention is to provide a coupling especially adapted for use in connection with gas-hose adapted to connect a standing burner or drop-light with a source of gas-supply, the connection being so made that when the burner is to be disconnected from the fixture and moved from place to place but a short length of tubing will be connected with the burner and the mating length of tubing need not be removed from source of supply with which it is connected.

PHOTOGRAPHIC PROCESS FOR THE REPRODUCTION OF PLASTIC OBJECTS.—C. BAESE, Berlin, Germany. In carrying out his invention Mr. Baese photographs the object to be reproduced, hereinafter to be called the "original," in a light graduated in the direction of the axis of the lens of the camera and in proportion to the relief of said objects or parts thereof and then repeat the exposure on another plate or film in homogeneous light or in light graduated in inverse proportion to relief of said object. He then prepares a diapositive of one of said negatives, and this diapositive and the other negative form the desired set of plates.

MILK-SERVER.—C. C. BENNETT, New York, N. Y. According to practice now in vogue it is frequent that several trips are necessary to deliver bottles where different families live in a single house. The present invention seeks to overcome this disadvantage by providing a device readily adjustable to the number of bottles or packages to be carried, so that whether a large or small number are to be delivered at one house the instrument will nevertheless be susceptible to such adjustment as will adapt it to the existing conditions.

Hardware.

COMBINED STOP AND LOCK FOR WINDOW-SASHES.—R. L. RILEY, Newburgh, N. Y. It may be briefly stated that in the embodiment of the inventor's improvements Mr. Riley employs a double combined stop and locking device located in a mortise or recess therefor in one side of a window-frame and in line with the meeting-rails of the two sashes of the window, one of the duplicate bolts of the device engaging with means on corresponding sash for preventing the sash from being opened without proper operation of said bolt.

DOOR-FASTENING.—L. A. DE MAYO, New York, N. Y. By means of this invention a door may be held securely locked or it may be held so that it can be partly but not wholly opened, and by proper adjustment of the parts by a person inside of the room to which the door leads the catch may be entirely disconnected. It may be applied to either right or left hand doors without modifying its construction.

Household Utilities.

CAKE-BEATER.—M. A. RITTER, Carlisle, Ky. Mr. Ritter's invention is an improvement in cake-beaters, seeking to provide a novel construction whereby the dough may be beat or worked the desired way and by which the dough may be scraped from the bowl when desired. The construction is simple, inexpensive, and will be found efficient in the practical use of the invention.

SECTIONAL CASE.—A. E. STENSHAUG, Ashland, Wis. In this patent the invention has reference to improvements in sectional cases for books or other articles, the object being to provide a case of this character so constructed that the several sections may be readily assembled and having a novel locking means for firmly securing the parts together.

Machines and Mechanical Devices.

DRYING APPARATUS.—H. HENCKE, Berlin, Germany. In this apparatus the arrangement has the advantage that when the material is brought upon the endless band the water or fluid is pressed out and the material itself is compacted, whereby it better adheres to the transporting-band. Also there are arranged means for the purpose of cleaning the band and removing impurities from its meshes before it enters into the trough containing materials. By this cleaning process the perviousness and roughness of the band is regenerated and the latter adapted to take up material again.

APPARATUS FOR EXHIBITING MOVING PICTURES.—N. POWER, New York, N. Y. The purpose of the vitascope is to provide registering and changing device conveniently operated during operation of the machine relative to the framing-opening, said device operating so that while the picture to be projected may be raised or lowered, for a perfect registry at framing-opening the rectifying mechanism acts independently of the body of machine and without interfering with action of any part carried by said body. Means provide a rectifying mechanism with an operating-lever frictionally held in adjusted position and means for increasing or diminishing tension.

DEVICE FOR TRANSMITTING POWER.—C. F. PEARSON, Chicago, Ill. In this patent the invention has reference to a device for transmitting power, commonly termed "planetary gearing." The objects are to provide a power-transmitting device which shall be capable of producing variable speeds and reversing. These results are intended to be secured with comparatively simple construction and efficient and absolute certain action.

EXCAVATOR.—C. L. PAYNE, Salem, Ind. The present invention has reference to improvements in machines for excavating ground for irrigation, laying pipe-lines and the like, an object being to provide an excavator of comparatively simple construction and by means of which the work may be rapidly carried on. While one set of digging devices is moved downward through the ground an other set is moved upward free from the ground, so that a large ground-surface may be operated with comparatively little expenditure of power.

REVERSIBLE FRICTION DRIVE-GEAR.—A. MACGREGOR, Elizabeth, and J. V. B. KENNY, Bayonne, N. J. The object in this case is to provide a construction of gear which is durable and efficient in service by the omission of weak parts that are liable to soon wear out by frequent adjustment of the parts required to reverse the driven shaft. In construction the several members are so combined and organized that very slight movement of pulleys relative to one another is all that is required to start, stop, or reverse the shaft, and the operation can be effected without jar or shock on the working parts.

TRITURATOR.—I. ST. C. GOLDMAN, Los Angeles, Cal. The triturator is arranged to insure proper reduction of substance to be treated by causing the pestle to be moved across the bottom of the mortar very rapidly on giving the pestle a pounding motion or allowing the pestle to work on the sides of mortar or to pass slowly across the entire bottom or up the sides of the mortar, according to nature of substance treated, to insure perfect grinding without danger of clogging, cramping, or fouling the machine, especially when treating gummy substances.

MULTIPLE RECEPTACLE FOR LIQUIDS.—A. L. PEPIN, Norfolk, N. Y. Mr. Pepin's invention relates to a multiple receptacle for liquids, and more particularly to an apparatus in which divers liquids, such as beverages of different kinds, may be stored separately and drawn either separately or two or more conjointly. The apparatus may be used in restaurants, hotels, cars, and all other places where it may be desirable for a person to select one or more of several liquids to be drawn off into a drinking-receptacle.

SAFETY DEVICE FOR FIREARMS.—O. G. VOLD, Dawson, Minn. The purpose of the invention is the provision of a combination locking device for the hammer operated at the exterior of the frame and which until properly set prevents the hammer from being carried to a half-cocked or fully-cocked position, and, further, means whereby the combination locking mechanism cannot be removed from the arm for purposes of inspection unless the person is fully acquainted with the setting of the combination.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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AUTOS.—Duryea Power Co., Reading, Pa.

Inquiry No. 6224.—For makers of rice-milling machinery.

Formining engines. J. S. Mundy, Newark, N. J.

Inquiry No. 6225.—For makers of bottles for soda water, on the same style as the English-made "Codd's ball-stoppered bottles."

"U. S." Metal Polish. Indianapolis. Samples free.

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Handle & Spoke Mchy. Ober Mfg. Co., 10 Bell St., Chagrin Falls, O.

Inquiry No. 6228.—For manufacturers of decorative glass spangles.

If it is a paper tube we can supply it. Textile Tube Company, Fall River, Mass.

Inquiry No. 6229.—For manufacturers of or dealers in voting machines similar to those used in New York State.

Adding, multiplying and dividing machine, all in one. Felt & Tarrant Mfg. Co., Chicago.

Inquiry No. 6230.—For machines for making gas from gasoline.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

Inquiry No. 6231.—For a mill for powdering licorice root or any similar hard root.

Leyden Chemical Works. Sole manufacturers of all luminous preparations. 666 East 182d Street, New York.

Inquiry No. 6232.—For toy steam engines and steam locomotives for experimental purposes, not to be over ½ h. p.

For sale patent No. 769,007. Window controller and lock. Inquire Henry Wohltman, 334 W. 12th St., N. Y. C.

Inquiry No. 6233.—For makers of twisted metal concrete and expanded metal for fireproofing and concrete construction.

DRY BATTERIES.—How to make and use them. Practical, with original drawings. Mailed for 25 cents. Spon & Chamberlain, 123 S Liberty Street, New York.

Inquiry No. 6234.—For a metal out of which to make a pump for pumping a weak solution of chlorine in water, without injuring the pump.

Patented inventions of brass, bronze, composition or aluminum construction placed on market. Write to American Brass Foundry Co., Hyde Park, Mass.

Inquiry No. 6235.—For makers of rug machinery for manufacturing old carpets into rugs; also for broom-making machinery.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Machine Company, Foot of East 138th Street, New York.

Inquiry No. 6236.—For a glass disk 10 or 12 inches in diameter from which to grind a mirror for a reflecting telescope.

A. Bensinger Co., 245 Broadway, New York, manufacture the "Rapid Duplicator" for making many copies of writings, that is marvelous as a money-labor saver.

Inquiry No. 6237.—For the address of the manufacturers of the "Eclipse" smoothing iron.

Any metal, sheet, band, rod, bar, wire; cut, bent, crimped punched, stamped, shaped, embossed, lettered. Dies made. Metal Stamping Co., Niagara Falls, N.Y.

Inquiry No. 6238.—For parties engaged in mining and crushing phosphate rock to be delivered in car lots, treated with acid, or simply crushed.

We manufacture gasoline motor and high-grade machinery, castings best quality gray iron. Select patterns, and let us quote prices. Frontier Iron Works, Buffalo, N. Y.

Inquiry No. 6239.—For machinery for making paper bags from flat sheets, and capable of sufficient variation in size to accommodate ½ and one pound.

Manufacturers of patent articles, dies, metal stamping, screw machine work, hardware specialties, machinery and tools. Quadriga Manufacturing Company, 18 South Canal Street, Chicago.

Inquiry No. 6240.—For a compensating valve for gas that will give a constant pressure at its outlet of 2 pounds to square inch.

Beginning with December 3, the SCIENTIFIC AMERICAN SUPPLEMENT will publish a practical series of illustrated articles on experimental electro-chemistry by N. Monroe Hopkins.

Inquiry No. 6241.—For manufacturers of corrugated rollers, such as used for corrugating wrapping paper boards.

WANTED.—Pattern and model makers by a western manufacturer of hardware specialties. Must be first-class workmen. Young men ambitious to excel preferred. Model Maker, Box 773, New York.

WANTED.—An expert electrician. Wages $30, to begin. State full particulars. See "Herald" Nov. 20th, for full particulars. "Downing," Box 446, N. Y. City.

Notes and Queries.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(9482) E. C. I. asks: A man recently made the statement that dew "falls" as rain does. When challenged, he said that recent investigations have shown that the old theory that dew is deposited or precipitated on objects colder than the surrounding air, is wrong. He will accept only the statement of the SCIENTIFIC AMERICAN. Will you be good enough to state briefly the latest theory (accepted) of the formation of dew? A. The condensation of water vapor in the air into water takes place upon chilling the air. This is seen as the earth cools toward night. The chilling takes place most rapidly near the ground. Grass and other vegetation cools more rapidly than the air above it. The air in contact with plants is thus cooled, and deposits its moisture upon the leaves of the plants. This is dew. The same thing takes place also upon rocks at times and upon fences. Dew is thus deposited from the air upon surfaces with which the air is in contact, and it is formed right where it appears. It cannot be said to fall, in any exact use of term, nor have there been any new facts or theories on this subject in recent years. When the chilling of the air proceeds further, the moisture may be precipitated to a considerable height above the earth's surface, and it is then called "fog."

(9483) W. P. Y. asks: Will you please answer the following questions concerning storage batteries described in SUPPLEMENT No. 845? 1. There are sixteen plates 1-16 inch thick, separated ⅛ inch = 2⅞ inches, plus the outside wood strip ½ inch = 3⅜ inches. Why does the jar need to be 7 inches wide? A. The glass jars for the storage cells in SUPPLEMENT No. 845 are stated to be 6 x 9 and 7½ deep. Just why Mr. Hopkins selected that size we do not know. It is a size usually kept in stock. It will contain a good quantity of the electrolyte in addition to the bunch of plates, and seems to be a good size for that number and size of plates. If a size not far different from this is more available for you, there is no reason why you may not take it. You cannot probably make the bundle of plates as small as you calculate it to be. They will not fit with mathematical exactness. Far from it; they must not touch each other. 2. Description says when forming batteries discharge through a resistance of 20 or 30 ohms. Can I use incandescent lamps for this, and how many will I require to use? A. You can use lamps for a resistance in discharging the cells. To obtain 20 ohms, if you have cells enough to light the lamps, you will require about ten lamps in multiple. A 16-candle-power 110-volt lamp, hot, has about 220 ohms resistance, and ten such lamps will have about 20 ohms resistance. 3. I have built a dynamo as described in SUPPLEMENT No. 600. It works all right except the commutator. The bronze wears down faster than the mica, making it spark. I have thought of making another, and using oiled paper instead of mica. What would you advise? A. The most efficient remedy for the rapid wear of the commutator bars is to use harder material, brass or copper, for the bars. The brushes will wear less if made of carbon than if made of copper.

(9484) J. B. G. asks: Kindly inform me of some rule for calculating the relation between spark length and distance required in wireless telegraphy. I mean by this the distance between stations and the length of maximum spark which the coil can produce. In case there is no such law, could you give us approximately the spark length required to operate over three miles? Also, please state what coherer is best adapted to amateurs' use, and how much additional spark is necessary, as I suppose it would not be as sensitive as those used to obtain data on the subject. We intend making as much of the apparatus as possible, and would appreciate any information or references you could give us on the subject. A. We have published in our SUPPLEMENT, No. 1363, price 10 cents, a full description of a wireless telegraph apparatus intended for amateurs' use. If you get this, you will find the details you ask. The construction of a coil is described in Norrie's "Induction Coils," which we send for $1. So far as we know, the relation between spark length and distance is not a matter of calculation, but of experience. Under good conditions a spark of one inch will be detected at a distance of about a mile. If you wish to send three miles you should have a spark of three inches, although a somewhat shorter spark would transmit to that distance over water in favorable conditions.

(9485) L. E. B.. asks: 1. Can you recommend to me any books which would be of service to one taking up a course of instruction in physics? I should like to find something in the nature of a graded course, starting with the simplest lessons. A. A good book for beginning the study of physics is Carhart and Chute's "High School Physics," which we can send for $1.40 mailed. Following this, you can take up the study of any special part of physics, such as electricity, for which we can furnish you any books you may require. A most excellent general work is "Experimental Science,' a book which covers in a most excellent way the several portions of physics, with practical work, which must give one who follows it out a very comprehensive view of the whole field. This we can send you for $5 mailed. We call your attention to the inclosed circular of this book. 2. Will you please tell me whether it is true that the moon's rays, shining upon the face of a sleeping person, have any detrimental effect upon him mentally or physically, such as causing partial blindness, double vision, etc.? A. We have not the slightest belief that the light of the moon can do any of the things which you mention and which "old wives' fables" have charged it with doing. The word "lunatic" means one affected by the moon. But there is no scientific proof that anyone was ever made crazy by the rays of the queen of night. The light of the moon is simply sunlight reflected and softened by reflection from the cold polished surface of the moon. How can any occult effect be produced in such a way? The imagination must vividly affect one to produce such results from such means.

NEW BOOKS, ETC.

LLOYD'S REGISTER OF AMERICAN YACHTS. Published by Lloyd's Register of Shipping, 15 Whitehall Street, New York. 12mo.; pp. 500. Price, $7.50.

The second volume of the American Yacht Register, published by Lloyd's Register of Shipping, fully justifies the promise of the first volume, issued last year, and gives to yachtsmen what has long been needed, a thoroughly comprehensive directory of yachting. Much has been done during the year to correct and amplify the original information, and in particular to keep pace with the great change which is now taking place in the sailing fleet through the installation of gasoline engines. The list of power yachts, which includes 1,019 vessels, shows a very large number of old sailing yachts, once well known as cruisers or racers, which are now auxiliaries. Very full details of the engines of these and of other types of gasoline vessels are given. The list of sailing yachts includes 2,099 vessels, making a total of 3,118 yachts of over 25 feet over-all length in use in the United States and Canada. In this list every section of the two countries is represented, from British Columbia to Nova Scotia, and from Southern California to Maine and Florida. The list of clubs includes 159, and the list of yacht owners includes nearly 3,000 names. A list is given of the yacht designers and builders of the United States, with the various yachts designed or built by them. The official signal letters of all yachts are given in a separate list, and also a list of former names of yachts. The letterpress and the illustrations are of a very high order, and the colored plates of flags, of which there are no less than fifty-seven, are among the most complete that have come to our notice. They include the national flag, the international code of signaling, the United States Weather Bureau signals, the American and Canadian yacht club flags, of which there are nineteen colored plates and thirty-three plates of private signals of yacht owners, with forty flags to the page.

FIRESIDE ASTRONOMY. By D. W. Horner, F.R. Met. Soc., M.B.A.A. London: Witherby & Co., 1904. 32mo.; pp. 105. Price, 60 cents.

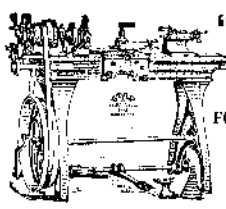
This pamphlet forms a simply-worded treatise on some of the little-known and often misunderstood facts in the science of astronomy. It was written for "the man in the street," who simply wishes to learn the reason of certain things that happen in the heavens, but who has not the time or means to investigate such matters for himself. The book is very simple in character and language, and should give the tyro a fair knowledge of the main principles of astronomy. It is illustrated with a number of sketches and diagrams.

THE VERMILION IRON-BEARING DISTRICT OF MINNESOTA. With an Atlas. By J. Morgan Clements. Charles Richard Van Hise, Geologist in Charge. Washington: Government Printing Office, 1903. Pp. 462.

This is Volume XLV. of the Monographs of the United States Geological Survey. It is large, well printed upon fine paper, and illustrated by maps, plates, and panoramic views of ore basins and mines. The various formations are separately dealt with, and there are photomicrographs of granules and their details.

FREE-HAND LETTERING. Being a Treatise on Plain Lettering from the Practical Standpoint for Use in Engineering Schools and Colleges. By Victor T. Wilson, M.E. New York: John Wiley & Sons, 1903. 8vo.; pp. 105; 13 full-page plates. Price, $1.

To begin with, great stress is laid upon the fact that good lettering is good design, and is an art not to be acquired by the assimilation of a few simple mechanical principles. The proper proportions of the various styles of lettering, of large to small letters, and of letters to spaces, are discussed from the artistic point of view. Many helpful examples are given of lettering suited to different purposes. The chapter on "The Use of the Pen" contains much common sense advice; its analysis of stroking gives the student a grounding in first principles that should serve him in good stead.



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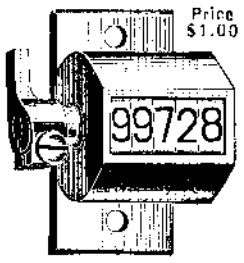

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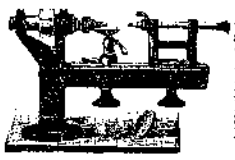

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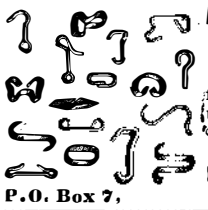

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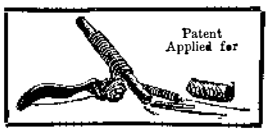

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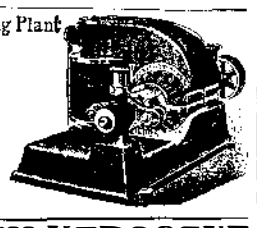

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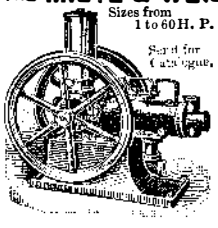

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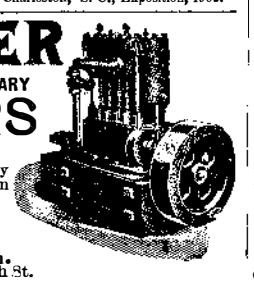

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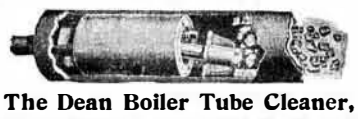

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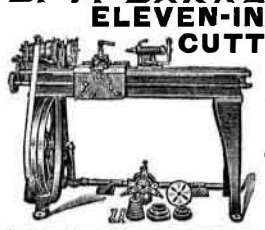

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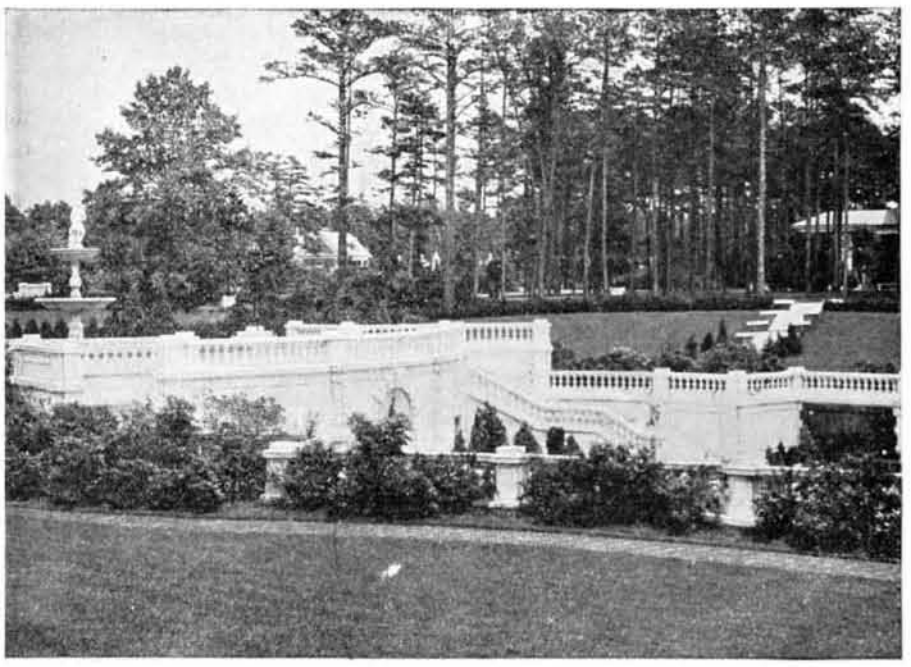

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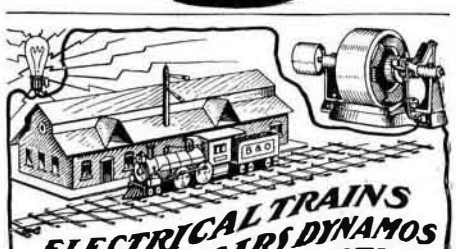

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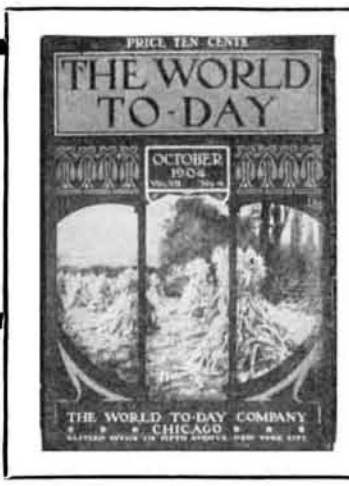

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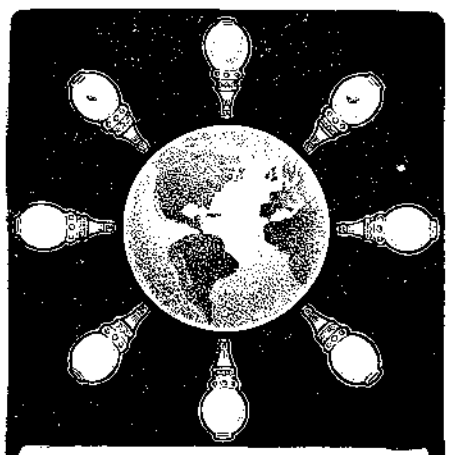

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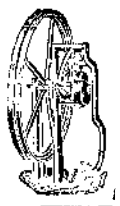

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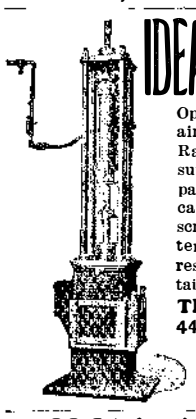

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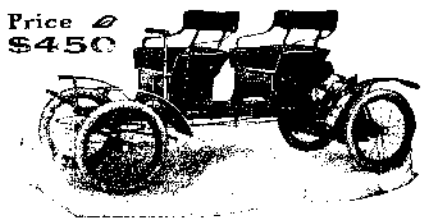

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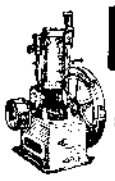

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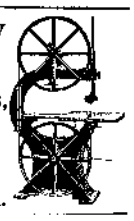

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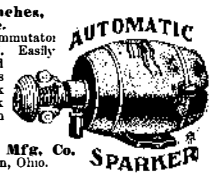

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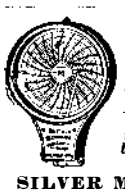

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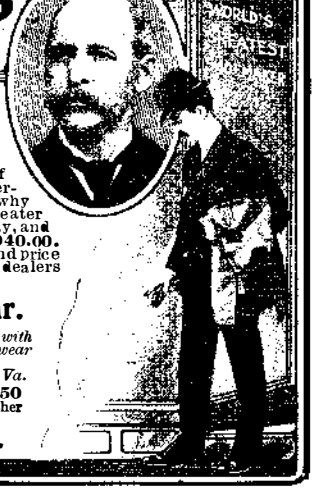

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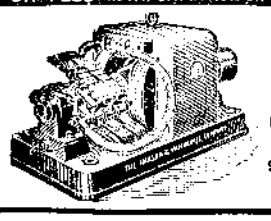

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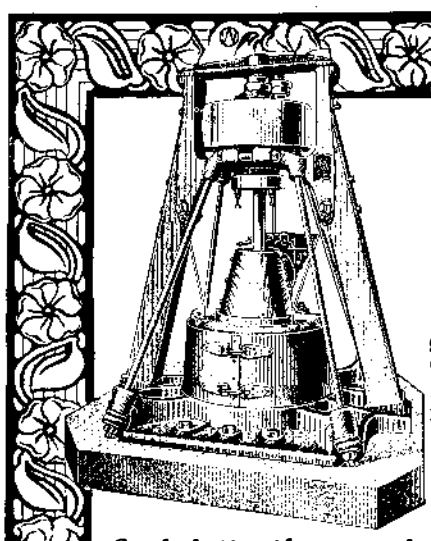

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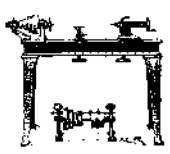

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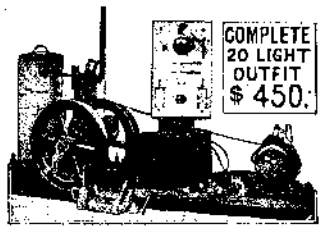

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